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ABSTRACT

This second of three volumes designed to bring relevant, interdisciplinary, environmental learning experiences to elementary students is written for grades 3 and 4 and is concerned with the student's local environment. Titles of the 10 units included in this volume are: The School Lawn; The Vacant Lot; Giants on the Land: Trees in Our Environment; Wild Ideas with Wild Plants; The Endangered Predator; The Cemetery; An Environmental Quality Index for the School and Neighborhood; Poetry in the Environment; Water; and The Breath of Life--or Death: Air Pollution. For each unit, objectives are specified, a series of learning activities are described, and appendixes giving teacher background information and listing references fór teaching resources are provided. (DT)

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# Environmental Learning Experiences
## for Grades Three and Four

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Ohio Department
of Education
Columbus, Ohio
1973

*Prepared by*
Center for the Development
of Environmental Curriculum
Willoughby-Eastlake City Schools
Willoughby, Ohio
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SE 017 961

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The continuing thrust toward environmental awareness has brought increasing realization that environment encompasses the totality of man's surroundings, both living and non-living, natural and man-made. Environmental concerns should not be separated from other areas of knowledge.

Increasingly, the need has been felt for teaching materials which would assist educators to infuse environmental concepts into existing curricula in a meaningful way. Environmental education should be a part of learning at all grade levels.

In response to this need, the Ohio Department of Education has developed a series of publications to assist schools in implementing an interdisciplinary approach to environmental education. The publications encompass a resource catalog; guides to distinct Ohio environmental study areas; a series of experience units; and a planning guide for outdoor education.

A Center for the Development of Environmental Curriculum was established in August, 1971, in the Willoughby-Eastlake City School District under an ESEA Title III grant administered through the Department of Education. The units in this volume were generated from materials developed by the Center and pilot tested in sixteen elementary schools in Ohio.

This collection of units is one of three volumes designed to assist teachers in bringing relevant, interdisciplinary environmental learning experiences to Ohio elementary students.

Martin W. Essex

Martin W. Essex
Superintendent of Public Instruction

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# Introduction

In order to provide a basis for construction of these units, the Center for Development of Environmental Curriculum analyzed several new curriculum programs in environmental education and science. One, the National Environmental Education Development program, was responsible for developing the strand approach to education. This approach is a strategy of looking at the world that ties the various fragments (like mathematics, music, history, and biology) into an understandable whole. Through the strands — patterns, adaptation, change, interdependence, and diversity, or PACID — a child begins to see that the world really is an indivisible fabric of matter and energy into which he himself is firmly stitched.

*Man and His Environment*, a National Education Association publication (Washington, D.C., 1970), provides the following definitions of the PACID strands:

> Patterns: Organizational patterns are kinds of structures that may be found in rock formations as well as in social groups of people and animals. Functional patterns include traffic movement and classroom schedules. Spatial arrangements are patterns that often please us. Such patterns occur both in nature and in artistic design.
>
> Adaptation: Over extensive periods of time, a great number of changes come about in order to enable an organism to adapt to the environment. Hereditary factors then preserve the continuing elements. The characteristics that enable the organism to adapt best are apt to be the traits passed on from generation to generation, thus ensuring survival of the species.
>
> Change: Living and non-living things are constantly changing, whether among galaxies and planets or within body cells and body systems. Some things remain the same in spite of change. Matter and energy may change in form, but they can never be created or destroyed.
>
> Interdependence: Nothing exists in isolation. Each individual is constantly interacting with living and non-living things: his family, his belongings, his friends and his world. These people and things also depend on the individual in order to function properly. The process is continuous as part of the life cycle even after death, for dead life forms nourish the living.
>
> Diversity: Many likenesses and differences occur among living and non-living things. A variety of functions, sizes, and structures exist in plants and stars, rocks and animals, processes and people. Yet there are sufficient similarities to permit their classification into orderly patterns. These classifications increase one's understanding of his world.

PACID, then, provides the conceptual orientation for these units. These principles form a basis for identifying, organizing, and studying the workings of the world as they manifest themselves in any body of knowledge.

Since environmental education impinges on every aspect of living and learning, these units are not intended to be taught as a separate subject, but to be integrated into the existing curriculum. Also, their arrangement in these pages implies no pre-ordered sequence in which they should be presented, though certain units have been placed before others because they present concepts basic to further understanding (for instance, Food Chains precedes Food Web).

For an environmental program to be successful, objectives must be identified in order to direct the experience toward the desired outcome. The Center for Development of Environmental Curriculum has identified the following objectives of an environmental curriculum for kindergarten through grade six:

- Critical thinking skills
- Problem identification and solution skills
- Knowledge of the biophysical and socio-cultural concepts
- Decision making
- Value and value formation
- Definition of priorities
- Personal environmental philosophy
- Avenues for maintaining or changing the environment

For a program to be effective, it must also have an organizational strategy. The direction in these units is from a heavy emphasis on affective experiences in the early grades to development of skills and content in grades five and six. In order to relate the curriculum to the conceptual development of the student, the environmental units consider progressively larger and more complicated environments.

The first level, from kindergarten through second grade, deals with the immediate environment. This is the environment that a student can directly experience in his immediate vicinity, on his level, one concept at a time: one tree, one kitten, one terrarium.

The units for grades three and four are concerned with the local environment, which includes what the student can directly experience by moving from one location to another: from the classroom to the cafeteria; the school building to the school yard; the forest to the meadow. Students consider both individuals within the community as well as community organization.

The third level includes grades five and six, and deals with the community environment. This environment may be a woodlot, a pond, a city block, a town, or a city. Students directly experience portions of the material, but they also have vicarious experiences through audio-visual materials or readings. Emphasis on socio-cultural and biophysical concepts increases. The skills of problem solving and critical thinking receive additional attention at this level.

# The School Lawn

Almost every house has a lawn or the residents there are trying to grow one. What a strange custom, cutting a bunch of little grasses all to one length as if we were trying to create a carpet in the woods. Not only do houses have lawns but most of our public buildings do too, including the school. Because the lawn is such a common feature, it offers a perfect opportunity for studying some basic ecological principles and small insect life. A good healthy lawn is like a small ecosystem and offers the child a chance to see an ecosystem in action. This unit is a good starting point for the unit on the vacant lot, the trees, or the wild plants.

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## THE SCHOOL LAWN

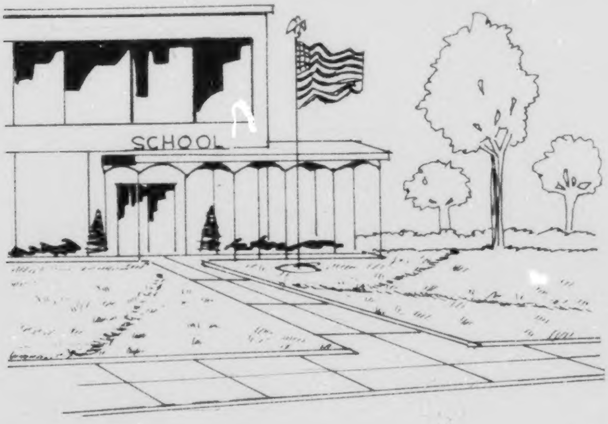
**Unit Objectives:**

The student will be able to

1. draw a rough representation of the people paths that criss-crossed the school lawn he studied.
2. relate the place of color in animal adaptation.
3. list three changes that took place in the 10-foot-square area of the school lawn that he used for an observational study.
4. distinguish between grass that has been grown dependent on water, soil, sun, and air and grass that has been grown independent of each of these life-giving substances.
5. list one of each object he found, in his micro- and macro-search of the school lawn, in the categories: a. Animal, b. Non-living, c. Plant.

### Environmental Experience 1: Patterns on the School Lawn

In any lawn, many patterns can be seen, and a school lawn is no exception. The patterns we are looking for in this experience will be called people paths. Most school lawns have certain areas where no grass will grow because of the constant use by students and visitors to the school. The shortest distance between two points is a straight line, and if that line means walking over the lawn, it will usually be done that way. In cases where the pavements are too narrow for the number of people using them, paths will show up on one or both sides. By mapping the area, the students can find where the major flow of people is concentrated in both entering and leaving the school building. Using a base map of the school grounds or graph paper, have the students map your school's people paths. After mapping these paths try to design and implement alternate routes. Block off the present people paths using stakes and string. Place warning signs on the strings to keep people off. If possible plant grass seed on the path areas, working the soil before you do to promote growth. Grass seed can be purchased for a minimal price at any hardware or garden store, and in many cases, stores will be happy to donate a small amount to benefit the school project. The students should request the custodian's assistance on this experience, as his advice will be useful and may save them a lot of time and trouble.



*Additional Activities*

☐ If you had the opportunity to design a new school lawn plan, what would you do? One large college in the east put in no sidewalks for the first two years. People could walk wherever they wanted to. After the people paths were well established, sidewalks were built on top of them. Design a new plan for your school lawn; consider play areas; use hedges and other plants to enclose areas or channel people certain ways. If possible, discuss your recommendation with the principal or other school officials.

☐ Observe and map other areas for people paths.

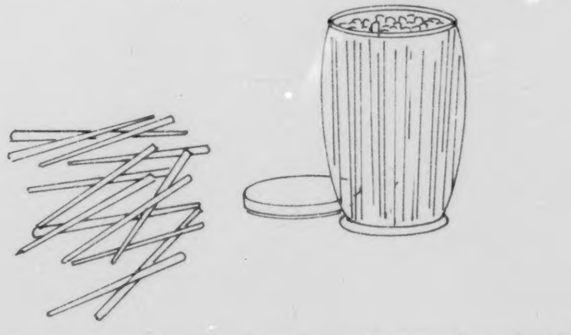
☐ Discover why grass doesn't grow in people paths. Using two large #10 tin cans with both ends removed, put one can into a people path and one into a grassy lawn area. Fill each can with water and time how long it takes for the water to percolate (soak) into the soil. What effect does this have on the suitability for growing things?

*Materials*

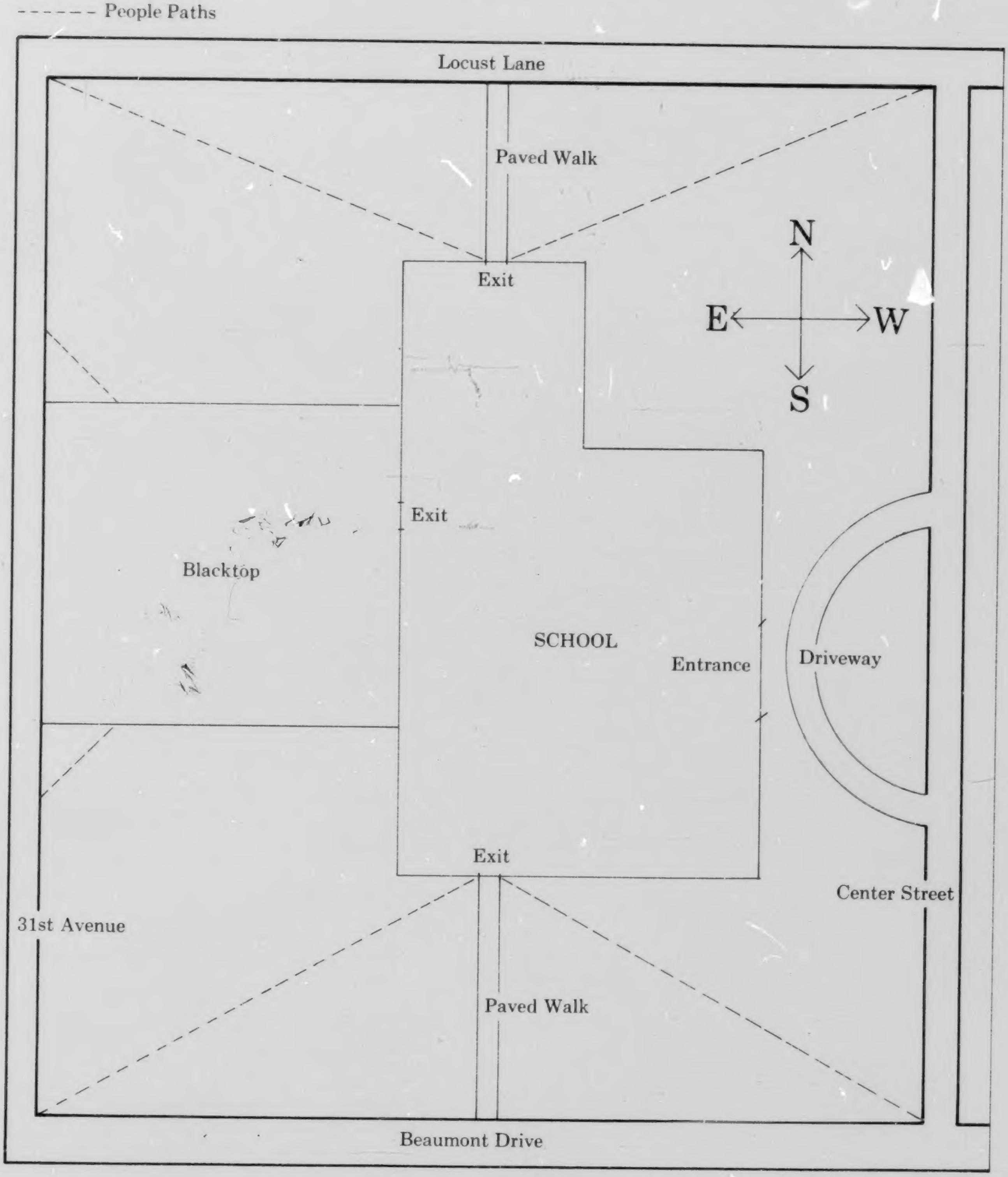
Drawing paper or graph paper
Two different color pens
Stakes or sticks
String
Poster paper for signs
Trowel
Magic markers
Grass seed

### Environmental Experience 2: Adaptation on the School Lawn

Color is a major form of adaptation for many plants and animals. Tropical fish have bright colors to help them hide in the coral reefs; some insects have colors that help them blend with plants; many flowers have bright colors to help attract insects for pollination. For defense, many mammals and reptiles take on the color of the habitat in which they live. What is adapted to living in the school lawn community and what colors should they be to survive? Using at least four boxes of colored toothpicks (blue, green, yellow, red, and natural wood) distribute these in a designated area of the lawn (e.g., a 20′ x 30′ rectangle). Count the total number of each colored toothpick before distributing. Push each toothpick into the grass or dirt so that it does not



Sample Map of School Grounds


------ People Paths
Locust Lane
Paved Walk
Exit
N
E
W
S
Exit
Blacktop
SCHOOL
Entrance
Driveway
Exit
Center Street
31st Avenue
Paved Walk
Beaumont Drive

show above the level of the grass. Divide the class into groups of three students each. For fun, have each child predict how many of each color will be found before you begin. When you are ready to begin, release the students. Average time given should be 15 minutes. When the time is up, return to the classroom and tally up the results. The group with the most toothpicks can be declared the "winner."

How many of each color were found?
What was the hardest color to find?
What was the easiest color to find? Why?
If you were a bug, what color would you be? Why?
If you were a red bug, where could you live? If you had to live in the lawn, what could you do for protection?
How does man use camouflage?

*Additional Activities*

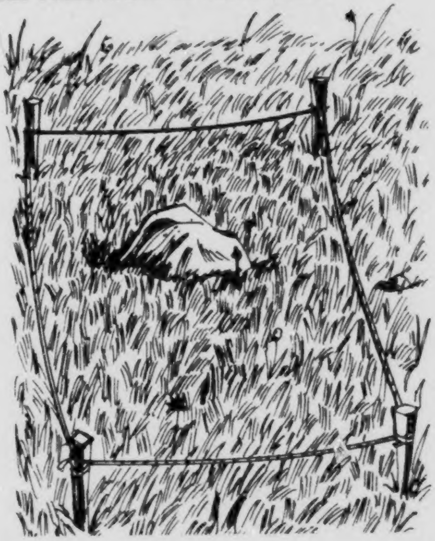
- ☐ Have the children now make believe they are animals looking for something to eat. The food is the remaining toothpicks on the lawn. See which students would perish because they could not find enough food to eat, and which students would survive because they could obtain food.
- ☐ Study in more depth the different forms of animal adaptive coloration. Show a movie on how animals protect themselves through coloration and other means. See bibliography for suggestions. Have each child make a report about one of these animals.
- ☐ Draw a picture of an animal using adaptive coloration and try to hide him in the background of the drawing.
- ☐ Collect some of the insects that live in your school lawn and discover their adaptive coloration.

*Materials*

Four boxes of colored toothpicks (red, blue, green, yellow, and natural wood)

**Environmental Experience 3: Change on the School Lawn**

Our world changes every day. Buildings are torn down, highways are built, forests are cleared and houses are built. These are large changes, easily seen. But what of the changes that are so small that they can't be seen until enough has taken place for us to notice, such as a car rusting or a flower growing? The school lawn is much like that, for unless the change is great, bulldozers moving earth or the janitor cutting grass, it often seems that nothing is changing. But changes are taking place every day. What are these changes and how can you see them? Rope off a ten-square-foot area using four sticks and a string. This will be your laboratory area or observation area. Observe this plot as many times as you can, either at the same time every day, randomly during the week, or once during each of the seasons. What has changed? Are there new flowers or plants? Are there spider webs in the grass or an ant's nest under the big rock? Or maybe the rock is no longer in the plot, having been moved either by man or by rain. Using a chart like the one following, note the animals and plants present in your plot and how they change from observation to observation.

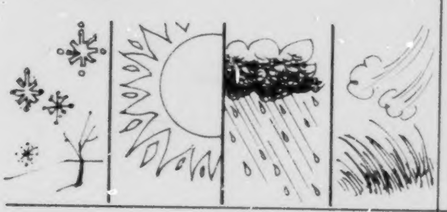


*Additional Activities*

- ☐ Do a base study of your plot first. What animals and plants lived there when you started? Diagram the location of the plot's feature on graph paper.
- ☐ Each time an observation is made, draw a new graph of the changes.
- ☐ Experiment within your plot. Scatter seeds and food for animals and observe what happens.

*Materials*

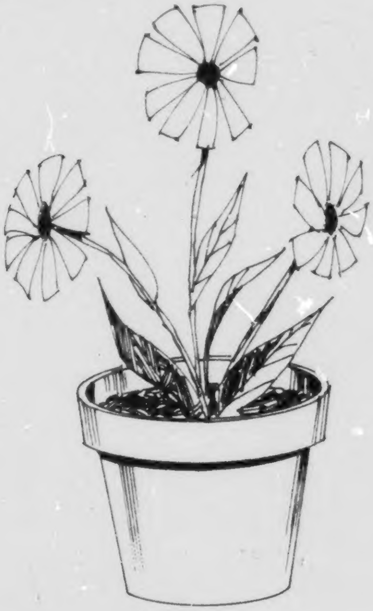
Plot observation chart
Pencils
Rulers or tape measures
Magnifying glasses
Microscopes (if wanted)
Stakes or sticks
String

| PLOT OBSERVATION CHART | Size or Location | Color | Number | Remarks & Other |
|---|---|---|---|---|
| Animals Amphibians Birds Reptiles | | | | |
| Grasses | | | | |
| Mosses, Lichen, Fungi | | | | |
| Insects, Worms | | | | |
| Weather  | | | | |
| Other<br>Litter Tracks | | | | |

## Environmental Experience 4: Interdependence on the School Lawn

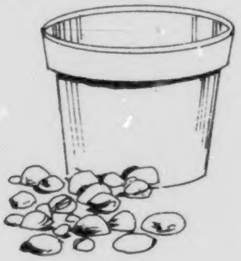
### *Part I: Plants*

The school lawn is a small ecosystem or community of organisms interacting with the environment. The community depends upon and is influenced by the habitat, the specific set of conditions that surround the organisms such as sunlight, soil, minerals, elements, moisture, temperature, and topography. Plants, a part of the community, are dependent upon water, air, sun, and soil. Set up an experiment showing necessity of these elements to plant growth.

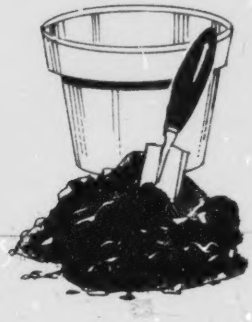


General Planting Instructions:

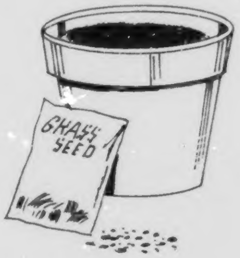
Step 1: Place several rocks over hole in bottom of five medium size clay pots.



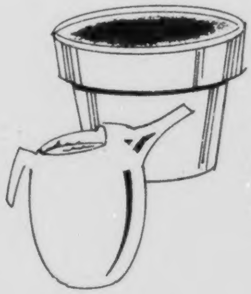
Step 2. Fill pots with soil (or rock mixture), leaving at least ¾″ at top.



Step 3: Cover top of soil with grass seeds. Gently press seed into soil.



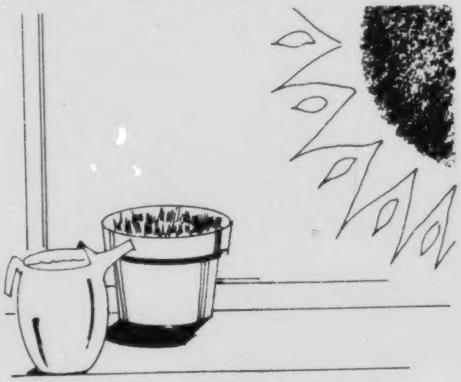
Step 4: Water (except pot 3) so that soil is all wet.



Pot 1: Good Soil, Water, and Sun (Control)

*Instructions:*

1. Good soil (buy from garden supply).
2. Water: Twice a week so that soil is evenly watered, no water standing on top of soil.
3. Place in a sunny window.

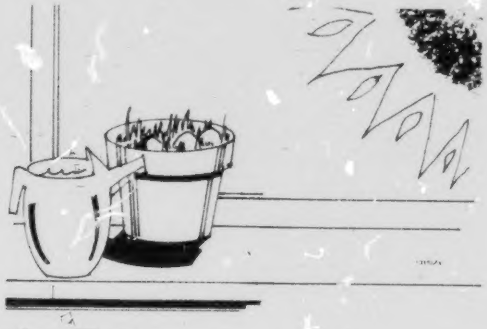


Testing: Soil

Pot 2: Rocky Soil, Water and Sun

*Instructions:*

1. Use *rocky* soil: A mixture of gravel, sand, and soil; ½ gravel, ¼ sand, and ¼ soil.
2. Water: Twice a week so that soil is evenly watered; no water standing on top of soil.
3. Place in sunny window.

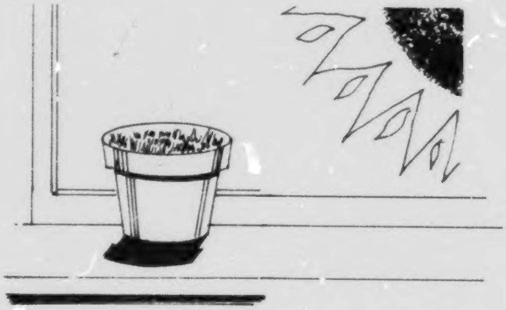


Testing: Water

Pot 3: *No Water*, Good Soil, and Sun

*Instructions:*

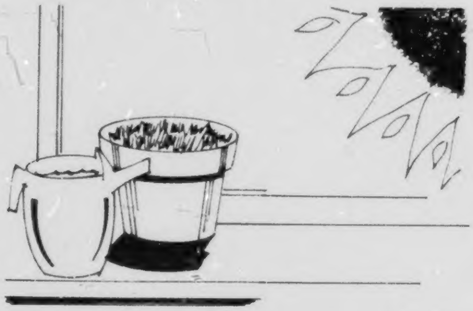
1. Use good soil.
2. No water!!
3. Place in sunny window.



Pot 4: *Too Much Water*, Good Soil, and Sun

*Instructions:*

1. Use good soil.
2. *Too much water:* water heavily every day.
3. Place in sunny window.

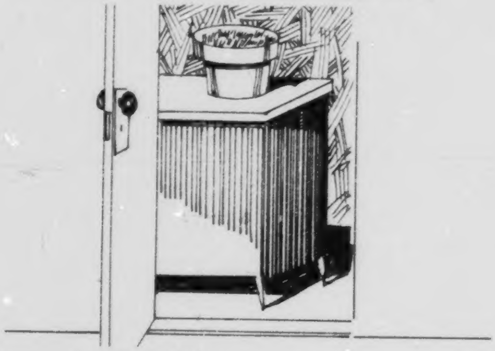


Testing: Light

Pot 5: *No Sun*, Good Soil, and Water

*Instructions:*

1. Use good soil.
2. Water: Twice a week, so that soil is evenly watered; no water standing on top of soil.
3. No Sun: Place in closet or under box.



Observation Schedule:

1. Before planting, take a poll of the predictions of the outcome of the experiment (form a hypothesis of the outcome). Keep a written copy of the predictions.
2. Set up experiment, making sure each pot is labeled so that they are not confused; also make sure the plants are watered only at the prescribed time.
3. This experiment probably will last two weeks.
4. There will be two major observations, one at the end of the first week and one at the end of the second week.
5. Do not view pot 5 at all during the first week, so as not to expose it to light.
6. Observations to be made at the end of the first week:
   a. Are any grass plants showing?
   b. If so, approximately how many? Light growth—Medium growth—Heavy growth—
   c. What is the general height of the grass?
   d. What is the general condition of the grass?
   Color: Green
   Yellow
   White
   Brown
   Texture: Thick and strong
   Thin and limp
   Brown and dry
7. Based on your observation, form hypotheses as to what the plants will look like at the end of the second week. Keep a written copy of observations and predictions.
8. At the end of the second week, observe the plants again using the same criteria.
9. Review your predictions and summarize the outcomes.

At the end of the two weeks, discuss the dependence of plants upon the elements sunlight, water, and good soil. How would the absence of these affect the school lawn? What would happen to the food chains if any of these elements were missing?

*Additional Activities*

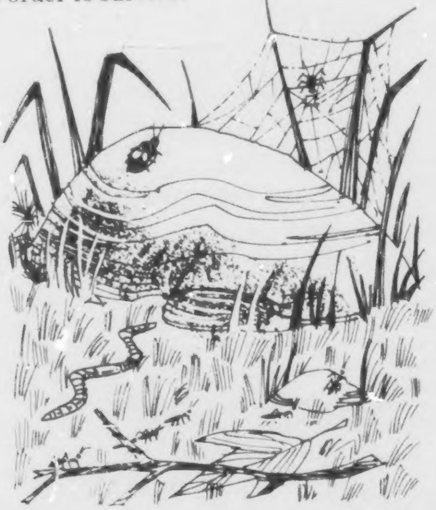
☐ Continue the experiment using actual soils from your school lawn.

☐ See if you can revive the plants from the first experiment by adding the element that was missing. Discuss fertilizers and rotation of crops. Discuss the effects of pollution on the growing of plants.

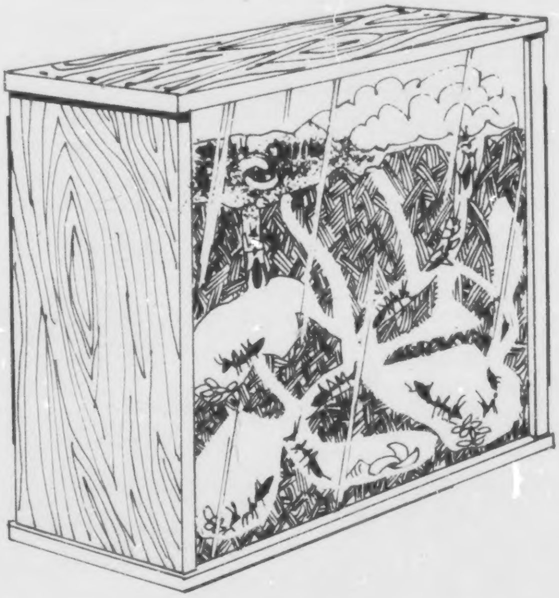
☐ Carry out the original experiment in the school lawn, if possible. Sunlight can be blocked out with a box. Metal stripping can be used to divide sections of turf.

*Materials*
Five medium sized clay pots
Potting soil from a garden shop or nursery
Grass seed
Small rocks for drainage
Sand and gravel
Watering can
Labels for pots
Trowel
Ruler for measurement of plants
Pencils
Observation sheets or notebooks

*Part II: Animals*
Dependence means needing something or someone in order to survive. The plants were dependent upon the sun, the soil, and water in order to grow and survive. The animals in turn are dependent upon the plants for food in order to survive.



And eventually the soil is dependent upon the decomposition of the plants and animals to obtain minerals to start the process over again. But dependence for survival is not only present between plants and animals and between different types of animals, but it is present right in animal groups. Dependence and cooperation can be seen in bird flocks, wolf packs, honey bees, and monkey groups. Cooperation and dependence can also be seen in human families. Cooperation in food getting, protection, rearing of young and home building are only a few of the ways animals depend on each other. An excellent opportunity to see animals' cooperation at work is in an ant colony or ant farm. They are easy to construct, maintain, and interesting to watch. The simplest type of ant farm is made of two pieces of glass set in a wooden frame. The frame and glass can be any size, depending on the size of farm you want. The glass panels should be set about one inch apart. See diagram for details. The glass should be darkened with some opaque material such as colored plastic or a piece of exposed x-ray film from your local hospital. This is then filled with the ant-dirt mixture, leaving a two or three inch space at the top. The dirt should be taken from the ant nest so that you have ants in every form of development. The queen ant is usually not too hard to recognize due to her large size. You must provide food and water for your farm. Put a few insects or pieces of honey or molasses on a small piece of bread for food and water-soaked cotton as a source of water.



*Additional Activities*
- ☐ Observe how other animals are dependent upon each other for food and protection.
- ☐ Build other insect communities and observe how they are dependent.

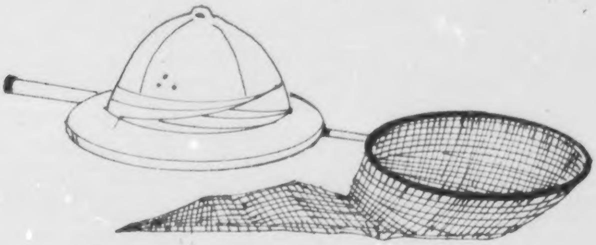
*Materials*
Wooden slats or boards
Two pieces of glass the same size
Exposed x-ray film or colored celophane
Dirt and ants
Cotton
Food

**Environmental Experience 5: Diversity on the School Lawn**
In this experience, the children all become big-game explorers. Since it would be impossible to have the children depart for a field trip to the African continent to stalk lions, elephants, and water buffalo, they can do the best possible thing and explore the lawn of the school. Since this is a much smaller area, they can be searching for much smaller plants and animals. But if, like the African continent, the school lawn is a healthy environment, then it must be diverse in its plant and animal species. The large animals that might be found around the lawn would be mice, squirrels, dogs, cats, rabbits, chipmunks, birds, or reptiles. The smaller animals could include insects, worms, spiders, small am-

## Lawn Diversity Chart

| ANIMALS | PLANTS | NON-LIVING |
|---|---|---|
| | | |

phibians, or small reptiles. Plant matter could include grasses, wildflowers, shrubs, trees, leaves, or seeds. Non-living matter would include soil, rocks, water, metals, or plastics. While big-game explorers are armed with expensive paraphernalia and ammunition, the children can be armed with binoculars and magnifying glasses, if available.



Divide the class into small exploring parties of three to six each. Each group will be given a pair of binoculars and a magnifying glass. The first search will be with the binoculars. The children will investigate those areas around the school lawn that they cannot see closely enough. Elect an exploring party secretary, who will write down all the plants, animals, and non-living matter that they observe. Next, conduct a microsearch of the lawn on hands and knees using magnifying glasses. Again write down any plants, animals, or non-living matter observed. A chart is provided to make this task easier.

After this part of the experience is completed, the children can return to the classroom and discuss their findings. They may find that the school lawn is made up of many more organisms and objects than they thought possible. If the lawn were allowed to grow into a field there would be many more things available, but they would be different.

What does a lawn look like when it is not well kept? What is a vacant lot? Is it the same as a neglected lawn? Would there be more animals in a cared-for lawn or an over-grown lawn or would there be different animals? Visit an over-grown lawn and observe it as you did the school lawn. What differences did you find? Compare your results.

**Environmental Experience 6: Men and Lawns**

Did you ever wonder where and when lawns really got started? Whoever thought to cut all the grasses to the same length making a carpet outdoors? Believe it or not, most of the grass types in our yards today are not native to America and had to be imported. The famous Kentucky bluegrass, which is a native of Greece and is mentioned in ancient writings, was supposedly brought to the new world by the French explorers, Marquette and La Salle. Part of their missionary work to the Indian included the distribution of seeds. So bluegrass was already well established and thriving years before any American settlers came to Kentucky and Ohio. Another common lawn grass is called Bermuda grass, and its arrival is stranger still. It is now believed that this type of grass came by accident in the fodder for the cattle on Hernando de Soto's ships. Many of the weeds, such as the broadleaf plantain, are also thought to have come this way to the New World. How do you feel about grass and lawns? What if the explorers never brought grass with them? What would our yards look like then? What benefits do we receive from having grass lawns? What have we lost because forests have been replaced by lawns? What should be done, if anything? For example, should your school lawn be made into a forest like it might have been at one time? Set up a hypothetical panel discussion to decide the fate of your school lawn.

Here are some questions to use as guidelines in your discussion:

**Questions for Panel Discussion**

Pro Cultivated Lawn:

1. How beautiful would the school look with a field growing around it?
2. Would the taxpayers who pay the bill for the school permit a ragged field growing around it?
3. Would the mosquito and other insect problems increase?
4. Would there be any danger of poison ivy, stinging nettle, or other of these types of plants occurring in greater abundance?
5. Shouldn't this effort be directed at a land laboratory rather than the school lawn?
6. Would the field eventually obscure the school from the road, thus increasing danger of children being involved in automobile accidents?

Anti Cultivated Lawn:

1. Wouldn't the use of fertilizers, herbicides, and the like, that endanger the environment, be greatly reduced?
2. Wouldn't the field attract many more birds and predatory insects, thus reducing the need for insecticides and pesticides that so greatly damage our natural environment?
3. Couldn't the field be used as an important environmental study area for the school children?
4. Wouldn't turning the lawn into a field greatly reduce the time the custodian had to spend taking care of it, thus saving the taxpayers' money?
5. How can the taxpayers complain when the schools are supposed to be for the students?
6. Shouldn't the schools be less interested in beauty than in giving the students the best education possible?

*Additional Activities*

☐ Research the history of lawns in America and the spread of lawns in your town.
☐ Study and read about foreign plants and how and why they were brought to America.
☐ Invite your school custodian or lawnkeeper to attend or take part in your panel discussion.

# Appendix

**Vocabulary List**

Camouflage
Adaptation
Mimicry
Community or ecosystem
Interdependence
Diversity
People path
Protective coloration

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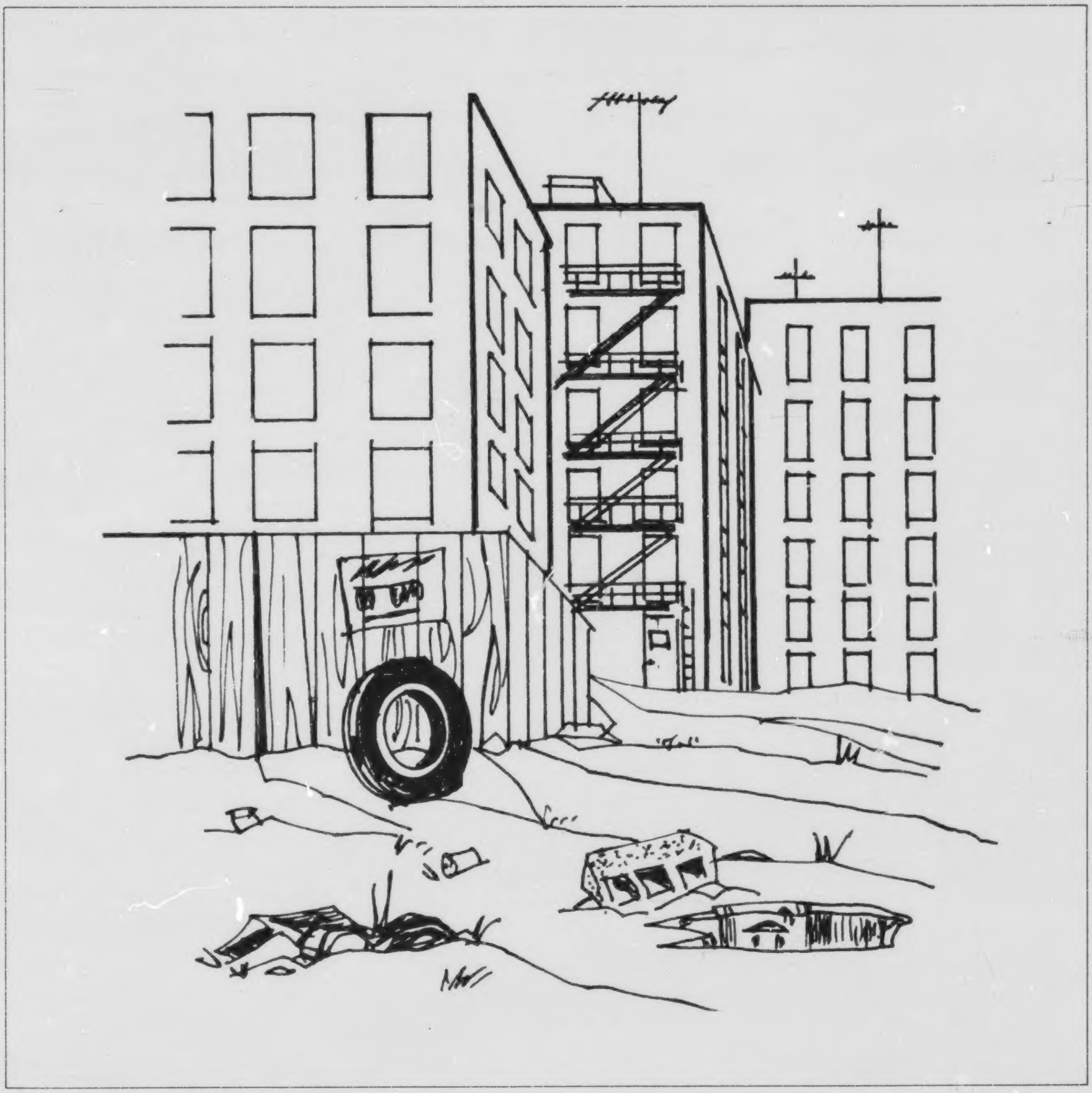

# The Vacant Lot

It has been predicted that by the year 2000 much of our country will become one vast city stretching across valleys, plains, and mountains. Even today most of our population lives in the city or in urban areas. And because of the long held view that the environment or nature can be studied only in the woods or the country, many teachers have not been able to teach these in these areas because of lack of money or time for field trips. But an understanding and awareness of the environment can be found anywhere, even in the heart of the city.

Because the environment is everything that surrounds us, the teacher need not worry about lack of money or buses. This unit is offered as a guideline to studying the environment wherever it is: in the country, in the urban area or in the inner city. If you have no fields or woods, use a vacant lot.

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## THE VACANT LOT

**Unit Objectives:**

The student will be able to

1. name at least two examples of patterns that were found on the vacant lot.
2. demonstrate his knowledge of adaptation by identifying the characteristics which enable at least one species of life to exist on the vacant lot.
3. relate at least two historical and natural changes that have taken place on the vacant lot over the last 200 years.
4. develop a food chain associated with the vacant lot (and demonstrate by means of arrows how each member is dependent on the other members of the chain).
5. list the natural and man-made objects associated with the vacant lot and be able to determine if the lot is diverse enough in the number of species associated with it.
6. identify conflicting points of view and evaluate their outcomes.

### Environmental Experience 1: Patterns on the Vacant Lot

This experience will be broken into two half-hour sections. The first will be in the form of a scavenger hunt where the children will collect different examples of patterns from the vacant lot, and the second will be conducted in the classroom as an art lesson with the children using the materials they have collected to make a collage of patterns on the vacant lot.

*A Shape Hunt*

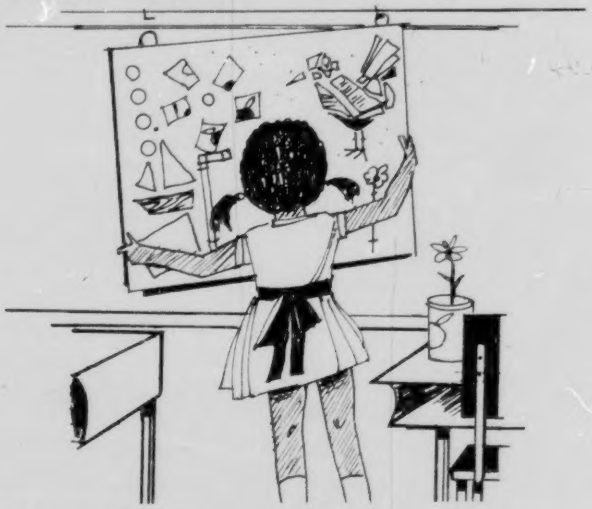
The teacher will first explain to the students which shapes they will be looking for when they travel to the vacant lot. A scavenger hunt means that the student will be given a certain number of predetermined points for each shape he finds but he must be able to define his find (the flower is round like a circle; all the sides of a box are the same size, like a cube; the bird's beak is round and comes to a point, like a cone). Some examples of shapes and point totals are given below. The teacher may wish to add, delete, or change the point totals. The only request is that the student be allowed only one of each type of object on the lot.

| | | |
|---|---|---|
| Circle | (tire, bottle cap) | 10 points |
| Star | (certain flowers, bits of metal) | 20 points |
| Cylinder | (piece of pipe, plant stem) | 10 points |
| Cube | (wooden blocks, box) | 15 points |
| Cone | (paper products, bird's beak) | 15 points |
| Rectangle | (old board, box, brick) | 10 points |
| Pyramid | (scrap pieces of metal, wood) | 25 points |
| Oval | (rocks, pebbles, seeds) | 5 points |
| Square | (box, paper, board, sections of plants) | 10 points |
| Spiral | (bed spring, snail, some plants) | 20 points |

After the time is up the children can then take those things they have collected back to the classroom. The children will then tally up their totals and defend them if challenged. The student with the most points wins the scavenger hunt. See appendix for worksheet on shapes.

*Patterns in Trash and Stuff*

For the second part of the lesson the students will paste or hang the materials they brought back to the classroom on a piece of wood, a section of heavy cardboard, or some flat surface chosen by the teacher. They may choose a design of their own and when finished display, in appropriate place, their completed collages.



*Additional Activities*

- ☐ Different clean-up campaigns could be conducted using the vacant lot and looking for different types of patterns.
- ☐ Collect tin cans and trash and make junk sculpture.
- ☐ Develop a PACID slide show using scenes from your vacant lot.
- ☐ Make something useful from [illegible] of junk from your vacant lot (for example, a [illegible]er from a large tin can).

*Materials*

Notebook
Pencil
Collecting bag

Large board or heavy cardboard
Paste
Hanging hooks

**Environmental Experience 2: Adaptations on the Vacant Lot**

Adaptation is the successful interaction of an organism with its environment. Some organisms have been successful while others have not; passenger pigeons didn't make it but house sparrows did; certain plants will not grow on the vacant lot but others will; the bald eagle cannot live in the city but many birds do; and more rats can live on a lot covered with refuse than on one that is periodically cleaned and taken care of. After these concepts have been conveyed to the children they are ready to go to the vacant lot for a half-hour observation period. They will be asked to take along their notebooks and record the following data:

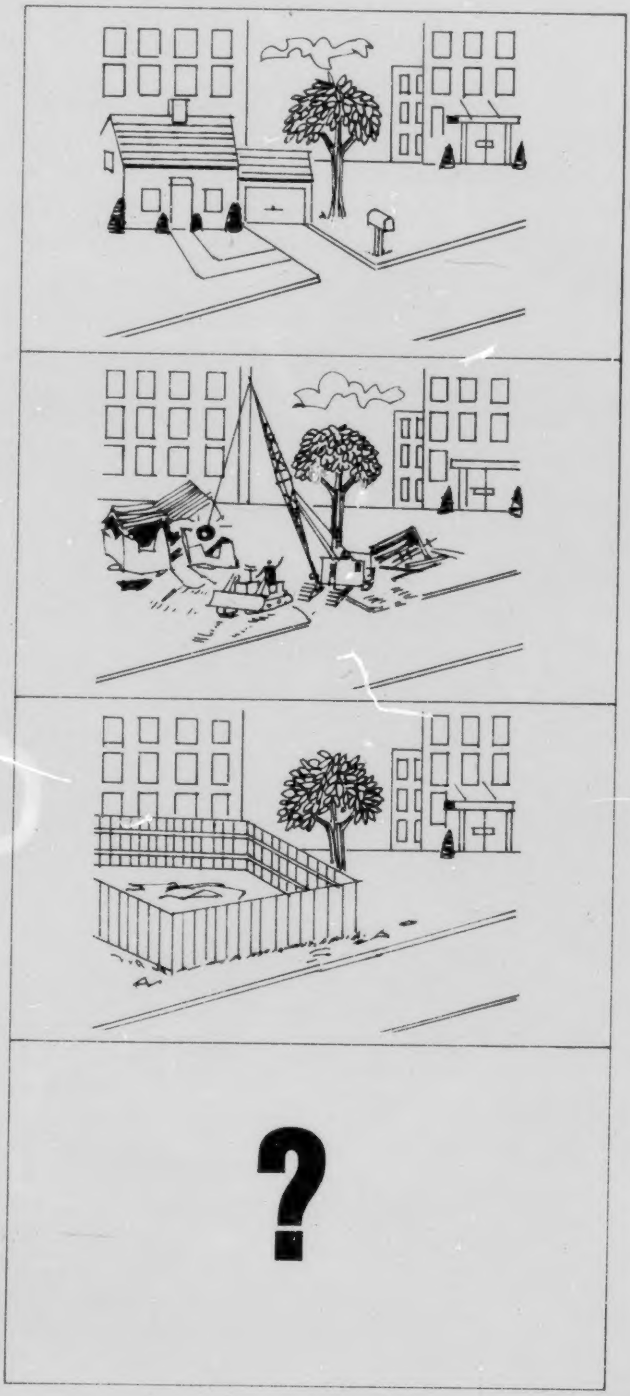
What animals do you see on the lot?
What are the animals doing?
Are they eating?
What parts of their bodies do they use to eat with?
Could you live very long if you had to eat what they eat?
How near can the teacher approach an animal on the lot?
Would an animal that wasn't used to man let someone get very close?
How do the animals get away from enemies?
Do you see any small mammals (rats, mice)?
Do you ever see them during the day?
When would they eat?
What would eat them?

The teacher could add more questions of this type, if she wished, and after the observation period the children should have some idea that all the animals they observed had one or more unique features that enabled them to adapt to the environment in which they lived. The children now have the next half hour to draw a make-believe animal that they think could live on the vacant lot. Take the part of the animal and tell or write a story about yourself and your life style. The animal can be any shape, size or color, but he must fulfill the following criteria.

The animal must:
Eat something on the lot
Have parts of his body adapted to finding and eating this food
Be able to escape from other animals
Be able to find and drink water

*Additional Activities*
☐ Investigate how plants and people adapt to the vacant lot
☐ Study the animals of the vacant lot in depth.

*Materials*
Notebook
Pencil
Construction paper
Crayons, paints or pastels



### Environmental Experience 3: Historical Changes on the Vacant Lot

Everything in the universe is constantly changing. The vacant lot is no exception. Over the years many changes have taken place in the lot and by looking into the lot's past history we should be able to find many bits of evidence that attest to the fact that the lot is in a constant state of change. To do this the children will write a short history of the vacant lot using the five following specific years as major points of research: 1800, 1850, 1900, 1950, and 1972. Books, periodicals, pamphlets, and magazines could be used as well as visits to a library, city hall, and other places where records might be kept. The children could either do this research as a class or be split into five different groups and concentrate on one of the specific years. After the research has been completed, the work could be bound together in one volume and donated to the school library for the use of future generations of children who will be attending the school.

*Sample History:*

1800 — Group one found that in this year the lot was an open prairie. The city was not settled at this time and since there were no great numbers of people the lot was not affected.

1850 — Group two found that by this time farmers were beginning to move west and by now the lot had become a farm field. Crops such as corn, beans, and potatoes were being grown on the lot.

1900 — Group three found that in their year a major city was beginning to grow. The lot had now become a home for a man who worked in one of the local factories and his family.

1950 — Group four found that the lot had by now become an abandoned home. Rats and disease ran rampant through the house and quite a few children were hurt playing in it.

1972 — Group five found that through the efforts of a neighborhood group the house had been torn down and was supposed to be made into playground. No playground had been built and the battle was still being waged.

*Additional Activities*

☐ Present your findings to the whole school in the form of an assembly, pictures, bulletin boards or a mural.

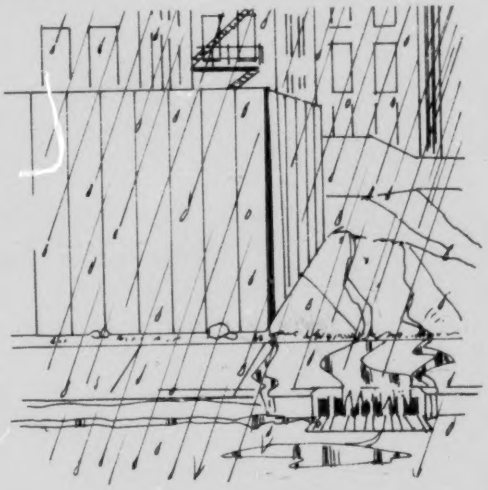
☐ Predict what the lot will look like in the year 2000 and illustrate your predictions.

*Materials*

Books
Magazines
Periodicals (on local history)
Pamphlets
Interviews with local citizens
Notebooks
Pencils
Local historians (if available)

### Environmental Experience 4: Natural Changes on the Vacant Lot

Natural changes as well as historical changes have been taking place on your vacant lot over the years. Some of these changes come with the changing of the seasons, a change in itself. What happens to your lot during the changing of the seasons? If possible, visit your vacant lot during as many seasons as you can, recording what you see through stories and pictures. If you can only visit the lot during one season, predict what the lot will look like during the other seasons. What animals and plants will be able to survive on your lot during the different seasons? Not only does your lot change every season and every year, it changes a little bit every day.



What kind of changes take place from day to day? Does the amount of litter or trash change? If you can, clean up part of your lot and see how long it will take for the lot to accumulate new litter and trash. Why did this happen? How can you stop your lot from becoming littered again? What about everyday natural changes? Are there any signs of weathering? Go to your lot after a large rainstorm or snowfall. Did your lot change? Are there now erosion gullies or cracks in the dirt? Find all the weathering changes in your lot and see if you can figure out how they were caused.

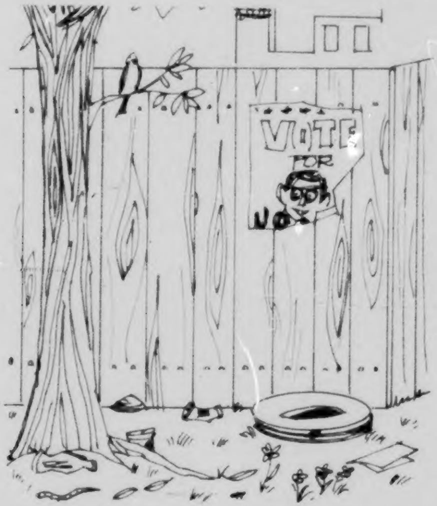
*Materials*

Notebook
Pencils
Drawing paper
Crayons, paints

### Environmental Experience 5: Diversity on the Vacant Lot

A diverse environment is often a healthy environment. A good healthy stream will be able to support many types of life such as caddis flies, stonefly nymphs, mollusks such as freshwater clams, worms, arthropods such as crayfish, trout and other coldwater fishes, and amphibians such as salamanders, frogs and toads. When the stream becomes polluted the amount of oxygen in the stream decreases. With the decrease in oxygen only those animals that need little oxygen can live there. Some of these are mosquito larva, rat-tailed maggots, sewer fungus, slide worms and carp. When land becomes polluted a similar displacement occurs. Has this displacement happened in your vacant lot? What animals live in your lot? Have they been replaced by other animals or things? Using the alphabet diversity hike, discover how diverse your lot is and what influence man has had on the lot.

Procedure:
Divide into small groups and have each group list as many natural and man-made items as they can find beginning with each letter of the alphabet.



| Natural | Man-Made |
|---|---|
| A. | A. |
| B. | B. |
| C. | C. |
| D. | D. |
| E. | E. |
| F. | F. |
| G. | G. |
| H. | H. |
| I. | I. |
| J. | J. |
| K. | K. |
| L. | L. |
| M. | M. |
| N. | N. |
| O. | O. |
| P. | P. |
| Q. | Q. |
| R. | R. |
| S. | S. |
| T. | T. |
| U. | U. |
| V. | V. |
| W. | W. |
| X. | X. |
| Y. | Y. |
| Z. | Z. |

After completing the experience you should be able to point out the lack of diversity of natural items on the lot. It is important that you now give the children time to clean up the lot as best they can. We have based the next experience on this activity.

*Additional Activities*

☐ One way to have the children see the lot in both its clean and dirty state is for them to take pictures before they do the experience and after it is completed. These photographs could then be displayed on a bulletin board with short stories the children have written about the lot.

☐ Extend the alphabet hike to include going to and from school, or the child's neighborhood or yard.

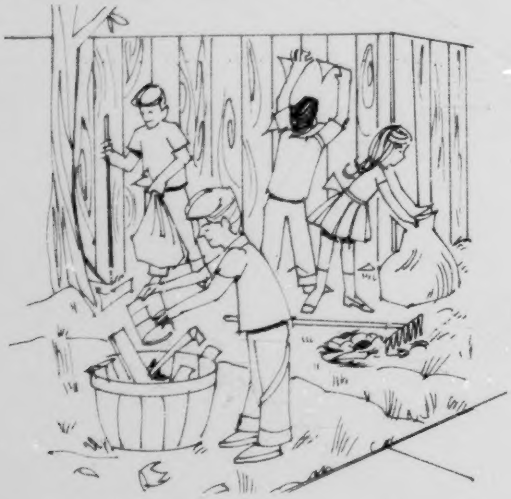
*Materials*
Sheet of paper with the alphabet and blanks to fill
Pencils
Collecting bags or trash receptacle

**Environmental Experience 6: Interdependence on the Vacant Lot**

Interdependence means to need to rely on others. Everything, in order to have a use or a purpose, depends upon something else. Since survival is one of the basic concerns of all living things, getting enough to eat is their biggest worry. The animals living in your lot must search every day for enough to eat and if they do not find it, they die. Earlier in the section on diversity, we talked about a healthy environment supporting many different types of life. Therefore, an unhealthy environment has a high number of only one or two types of animals and plants. When these animals can find enough to eat every day, their numbers will increase, and in order to survive they will have to spread out to other areas. When any one type of animal overpopulates an area, it will become a pest by spreading to areas where man lives. Some animals that have become pests in city areas are the rats, mice, pigeons, and cockroaches. These animals not only invade vacant lots and buildings but often carry germs that can cause serious diseases. How did these animals become so plentiful and what are they dependent on? Earlier we discussed the idea that since all animals must eat, they are dependent on other animals as food sources. In this system of animal and food source, a complex dependence line can form. This system is often called a food chain. Just as in a chain, each animal or link depends on the next link to hold the chain together. Therefore, in a good working chain, each link is strong.
*Here is an example of a food chain:*
Sun → plant → grasshopper → shrew → marsh hawk
Eventually the marsh hawk will die, and the minerals in his body will re-enter the earth and the system again. Each link in the chain is dependent on the next link in order to survive. But when something is missing the link will break and the chain collapses. This is often what has happened in a vacant lot. For example, first the sun helps the plants to grow; a mouse eats the plants; a cat eats the mouse. What if your city decided to kill all those stray cats? What will happen to the food chain? But leaving the stray cats is not always the answer. There were probably too many mice already for the cat population to control anyway. How did this happen? Mice not only eat plants but many other things. What else might mice eat? Do they eat the garbage thrown in the lot? How can this problem be solved? Should more cats be brought in? Should the city buy many mouse traps and poison? Or should the garbage and trash be cleaned from the lot? All of these solutions might help, especially the last. But there is

still a problem. When your mother cleans your room does it stay that way? Or does she have to clean it again the next week? What about the lot? Once it is cleaned, will it stay that way? Why not? How could you help the lot remain clean? Would your methods work? Would the link break and the lot revert to the way it was before? The lot is then dependent on you to keep it clean. If possible, obtain permission to clean your vacant lot. Write letters to local groups to get help. Design posters to help stop the littering problem.

If possible, make your lot into a park. Design park plans and maintenance schedules. Free planting can often be obtained from your county agricultural agent or local nurseries. Since keeping a park clean and healthy is a constant job, discuss how this might be done and what you can do to help.



*Additional Activities*

- ☐ If you plan to clean up your lot, have a dedication party at the vacant lot and invite the people in the community. Invite local officials and officers.
- ☐ View a film on making a junkyard playground. See appendix for some examples.
- ☐ Study city problems such as rats, mice, pigeons and cockroaches in more depth.

**Environmental Experience 7: Man's Relationship to the Vacant Lot**

After the class has completed its ecological study of the lot, they can now begin to determine a proper use for the lot. How could the vacant lot best be utilized? Could it perhaps be turned into a park or playground, or maybe, because of high property value, would it best be used as an apartment or office building site? Set up an imaginary court room, assigning students as judge, jury, lawyers, defendents and concerned citizens. The city has offered use of this land to anyone who will make a worthwhile addition to the city. In the case: Students for Vacant Lot Parks Commission vs. the City, have the students role play the different witnesses and officials. Have the class, as well as the jury, consider such evaluative guidelines as facts vs. opinions, prejudice and bias, and contradictory viewpoints.

At the end of the case, have the whole class, as well as the jury, write the verdict on the use of the park.

Court Case: Students for Vacant Lot Parks
vs
The City
(Some suggested viewpoints and opinions)

Example I: The mayor, who lives in an upper middle-class neighborhood on the other side of town, said, "That property is too valuable to use for a park. The city would receive approximately $10,000 per year if an office building were built on the lot. The city schools need more money to operate and this building would mean more children could be given a quality education."

Example II: The president of the local neighborhood improvement association replied, "The children in this neighborhood have no safe place to play. Last year alone there were nineteen children under the age of fifteen involved in automobile accidents because they had no place to play but the street. If the lot were made into a neighborhood park the children would not play in the streets."

Example III: The director of parks for the city, a distant relative of the mayor, said, "That spot is worthless as a park because it is too small. It would cost the city too much to run such a small park and very few people would use it. Children are going to be injured anyway and I don't believe the people in the neighborhood would appreciate it."

Example IV: The city superintendent of schools said, "While the schools need money desperately, the local children need someplace to play even more. The local school in that district was built over seventy-five years ago and because of poor planning there is not enough playground area. The vacant lot could be used as additional playground space. Besides that, there is no evidence that any additional tax revenue would be given to the schools."

Example V: The president of the area Save Our Parks Association, from her home in a fashionable suburb, said, "The city areas should have more parks but right now is a bad time. We are currently trying to get city and state together on building a large park with a wilderness area that will stretch across five of our large suburban counties. This will be easily reached by the people living in the cities. It is here that our money and time will do the most good."

Example VI: A local activist, involved in youth organizations and neighborhood clubs, said, "This is just a case of more nonsense from people who don't want to admit that this neighborhood exists. I have worked in this area for over twenty years and most of these do-gooders and politicians have never seen this section of the city. We are law-abiding citizens but if they build an office building we'll burn it down. This is our neighborhood and we'll decide what goes there."

Example VII: The owner of the lot was out of town but his business manager had this to say: "Mr. X is in business to make money. He'll sell the lot to whichever party gives him the most money. He feels he has already given a lot of money and prestige to this neighborhood and doesn't feel he owes them any more. It's his lot, so that's it."

*Additional Activities*

☐ Present the court case as an assembly for another class or the school. Have the audience vote as to the outcome of the case.

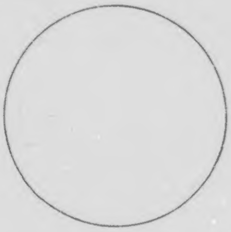
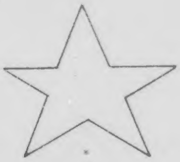
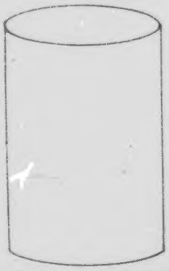
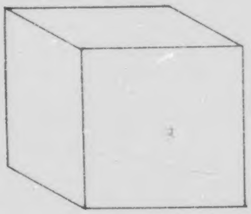
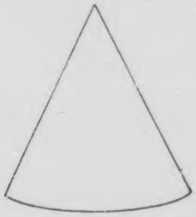
☐ Conduct the case from another viewpoint, for instance, Office Builders Company vs. The J. V. Paper Company.

*Materials*

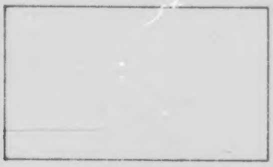
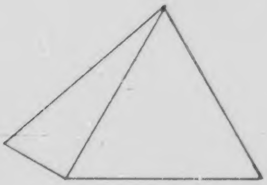
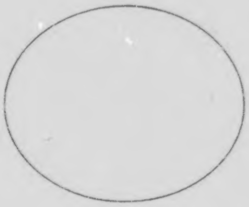
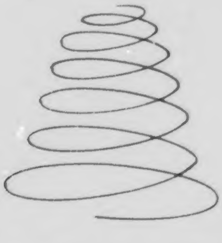
Props, if desired

# Appendix

## A SHAPE HUNT

| The Shape | # Points | Drawing of item (if can't collect) | Check if Found |
|---|---|---|---|
| Circle  | 10 | | |
| Star  | 20 | | |
| Cylinder  | 10 | | |
| Cube  | 15 | | |
| Cone  | 15 | | |

Student Worksheet

| The Shape | # Points | Drawing of item (if can't collect) | Check if Found |
|---|---|---|---|
| Rectangle  | 10 | | |
| Pyramid  | 25 | | |
| Oval  | 5 | | |
| Square | 10 | | |
| Spiral  | 20 | | |

**Vocabulary List:**
diversity
food chain
natural
man-made
adaptation
vacant
cylinder
cube
pyramid
oval
spiral
survival
interdependence
fact
opinion
prejudice or bias
contradiction

## REFERENCES

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Howell, Ruth. *A Crack in the Pavement.* New York: Atheneum, 1970.

McGue, George. *Ecology: The City.* New York: Benziger, Inc., 1971.

### Films

*Crack in the Pavement,* 8 min., Color, Rent Film Fair Communication, 10700 Ventura Blvd., Studio City, California 11604.

*Life in a Vacant Lot,* 10 min., Color, B/W, Basic Life Science Programs, Encyclopedia Britannica Educational Corp., 425 N. Michigan Ave., Chicago, Illinois 60611.

*Nature in the City,* 13 min., Color, Journal Films, 909 W. Diversey Parkway, Chicago, Illinois 60614.

*Uncle Smiley and the Junkyard Playground,* 13 min., Color, Learning Corporation of America, 711 Fifth Ave., New York, N.Y. 10022.

# Giants on the Land: Trees in our Environment

Often trees do seem like giants, but inconspicuous giants. They, like buildings, become part of the surroundings and fade into the background. The tree is an important part of the man-made world as well as the natural world. Without trees, the oxygen-carbon-dioxide exchange would be seriously hampered; our houses and furniture would be made only of bricks, concrete and plastic. The child needs to become aware of trees, by making a giant a friend, learning its worth and helping in its conservation.

Note: Some of the activities suggested in this unit are to be carried out over the whole school year.

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## GIANTS ON THE LAND: TREES IN OUR ENVIRONMENT

**Unit Objectives:**

The student will be able to:

1. describe the shapes and patterns of different parts of one tree.
2. explain how the tree adapts to the environment in which it resides.
3. list the changes that took place in the tree over a one-year period.
4. describe the things upon which the tree is dependent.
5. list the differences between the tree he has adopted and other species.
6. explain how man is dependent on the tree and what would happen to our life style if we could no longer count on wood products.

**Environmental Experience 1: Green Giants: An Introduction through Activities**

Become aware of the trees in your environment. Take a walk in your school yard. What kinds of trees are there? Try to describe the trees: a flaky, black, tall tree with large hand-shaped leaves. Have one child describe a tree to another and see if the other child can find it from his description.

View a movie about trees, their part in the natural world, how man uses them and how they change over the seasons. A list of three movies is in the appendix. Read books that are centered around trees: books about loggers, Paul Bunyan, tree houses, national forests, Luther Burbank and many others. Refer to the appendix for a few suggested books.

Learn to use a tree key and practice, practice, practice. Collect and read poems about trees; for example, Joyce Kilmer's poem. Write poems about trees and illustrate them for display in your room.

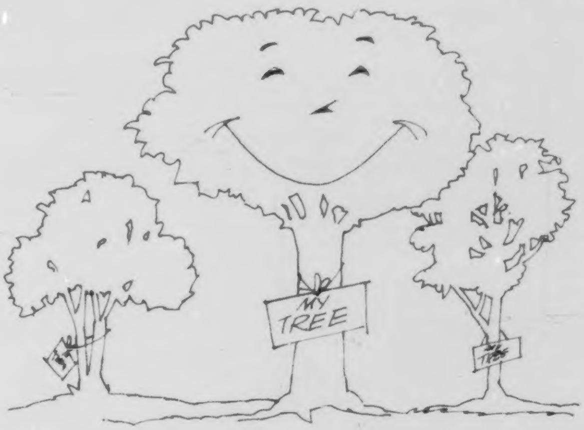
Put on a skit or play involving trees, or write one of your own.

Create a forest area in your classroom. Put all your books, charts, poems and pictures there. Make large paper or cardboard trees for atmosphere; they can also be used as backdrops for your skit.

Write to lumbering and paper products companies, such as St. Regis, Kimberly-Clark, Georgia-Pacific, Boise-Cascade, and ask for their information on trees and tree use.

**Environmental Experience 2: Adopt a Tree**

This experience should be used during the entire year. Each child will receive a worksheet and fill it out over the coming year. The questions can be answered in the teacher background section or the "Trees of Northeastern Ohio" booklet if the children get stuck. Each child should be able to adopt a tree of his choice near the school and should be given enough time during the year to observe and study it. If possible, each child should pick a separate tree as this will give him more of an idea that it is his research project. Trees of the same species may be chosen, as most children will see basic differences in many of the questions. During the year, the children should be able to share their experiences and data with the other members of the class.



Each tree can be marked with a name tag of the person studying it, so that other members of the school can realize its importance. The children should decide what type of tags they will put on the tree. This will show them how hard it is for arboretums and nature centers to keep their trees marked. Vandalism plays a big part in this and it will make the children see how discouraging this can be. Remember to let their ingenuity beat it, and not yours!

Most of the questions are self-explanatory, but if any problem arises, the teacher can assist the child in completing it.

### ADOPT A TREE

School year ______________

1. My name is ________________________________.
   (name or species of tree)
2. I am about ______________ feet tall.
3. I measure ______ feet and ______ inches around my trunk at a point about four feet above the ground.

4. This is the kind of leaf I wear:
(Make a leaf-print or outline.)

5. The autumn colors appeared in my leaves about
__________________.
(date)

6. These are the colors that appeared in my leaves:
Principal color: __________________.
Other colors present: __________________.

7. The first dry leaves began falling from my crown on
__________________.

8. Most of my leaves fell: (check)
In late October____ During December____
Between Nov. 1 and 15____ After January 1____
Between Nov. 16 and Dec. 1____

9. The very last leaves fell from my crown__________.
(date)

10. Without my leaves, my friends could see that my twigs are arranged on the branches as circled below. (Draw circle around correct pattern.)
Opposite Alternate

11. New leaves appeared from my buds__________;
(date)
and my crown was fully leafed out by__________.
(date)

12. My first flowers appeared on __________ and
(date)
there were flowers on me until __________.
(date)

13. My flowers came from: (check)
the same buds as the new leaves ______.
separate buds ______.

14. My friends first recognized well-formed fruits on me on __________; and my first mature fruits
(date)
fell to the ground on __________.
(date)

15. My bark feels:
rough______
smooth______
flaky______
warty______
Its color is __________________.

16. Draw a picture of me in the
a) Fall
b) Winter
c) Spring
(Attach your pictures to this worksheet.)

17. How am I different from other trees that live around me? __________________
__________________
__________________

18. What special adaptations do I have that enable me to live where I am growing? __________________
__________________
__________________
__________________

19. What plants and animals have you seen using me for food, shelter, nesting, protection, support, or other needs? __________________
__________________
__________________

20. What things do I depend upon to grow healthy and survive? __________________
__________________
__________________

21. My friends read about me and learned that men use me for __________________
__________________
__________________

22. Some of the ways I may become damaged or ill are
__________________
__________________
__________________

23. Some of the ways I may protect myself from harm are __________________

24. Some of the ways people protect me from harm are

25. What things in your classroom are made of me?

26. What materials does man use in place of me?

27. Do you believe man could live without my products?

28. What benefits besides my products do I give to man?

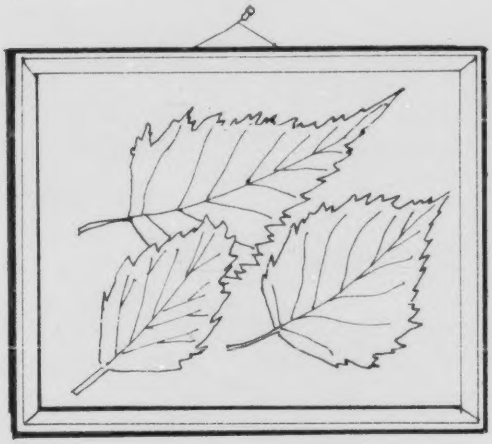
29. Do you think you could live in a world without trees?

30. Some other things my friend may wish to include about me

### Environmental Experience 3: How to Mount and Preserve Leaves

Preserved leaves are especially useful during the winter when green leaves are not available to use in displays and as teaching aids for tree study. A properly preserved and mounted leaf protected by a transparent plastic cover will retain its natural color and can be handled by hundreds of people and still remain undamaged. If a mount becomes soiled due to handling, the surface can be washed with soap and water since the plastic paper cover is waterproof.

Mounted leaves also can be included in various types of displays. Bark, fruits, seeds, or nuts can be displayed alongside the appropriate leaves. Leaf mounts are especially nice for portable displays since they are easily transported and stored.



This method of mounting and preserving leaves can be used to prepare very artistic and attractive groups of leaves of one species, or a spray of several twigs from one tree. In fall coloration, such mounts are especially attractive and worth framing to hang on a wall.

Leaves are an abundant resource and can usually be obtained without much difficulty. You may have to receive permission to collect leaves on private property, even if you plan to pick them off the ground. Collection of natural objects from parks is usually illegal. Contact park authorities if a particular species cannot be obtained anywhere else.

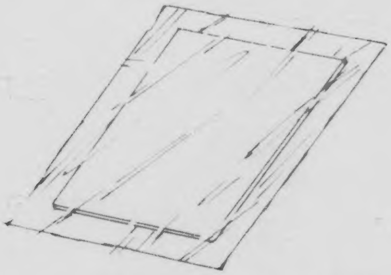
After collecting the leaves, place them at once between the pages of a magazine. This will insure that the leaves will remain flat, and will minimize the damage while in the field. Make a notation of the species, location where collected, and date on the page beside the specimen.

Leaves should be mounted immediately upon returning home from the field. This will insure that the leaves will keep their gloss, color, and lifelike look. Leaves that are pressed for a few days and then mounted usually lose their color and luster.

*Materials*
Illustration board (preferably white)
A self-adhesive plastic paper
Soft rubber roller
Transparent Con-Tact, manufactured by Cohn-Hall-Mar. Co. of 40 W. 40th Street, New York 18, New York, has been used satisfactorily by the naturalist staff of Columbus Metropolitan Parks. Other similar products may be used.

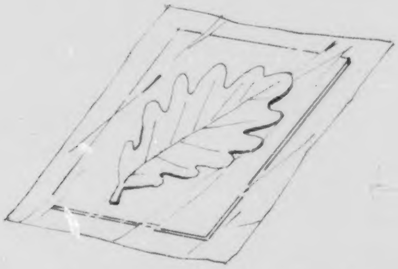
## Mounting Procedure:*

Step 1



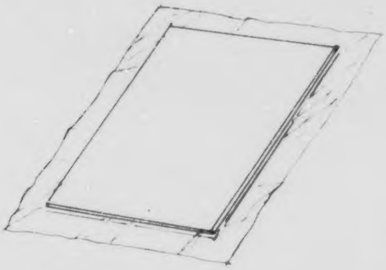
Place transparent paper sticky side up centered on the illustration board.

Step 2



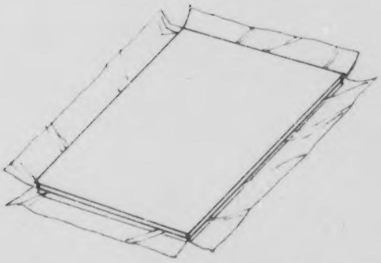
Place leaf upper surface down on sticky side of paper.

Step 3



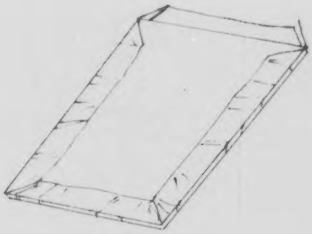
Place another illustration board on top of leaf and match edges of board with bottom board.

Step 4



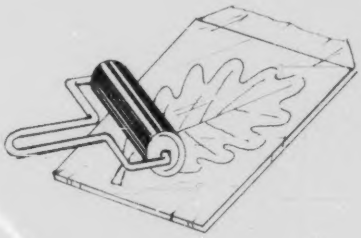
Cut corners of plastic paper off at an angle to the board.

Step 5



Fold over the two sides and one end of the plastic paper, leaving one end open.

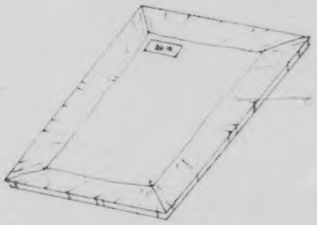
Step 6



Turn over mount and with a rubber roller or with your fingers move all the trapped air from sealed end toward open end. (Note: some air space will remain around leaf stems.)

*Mounting procedures by permission of the Columbus Metropolitan Park Board, 1251 East Broad Street, Columbus, Ohio 43205

Step 7



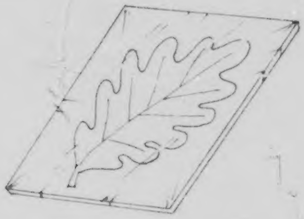
Fold over remaining end and run rubber roller over back folds, making sure plastic paper is sealed. Place gummed label with collecting information on back of mount.

Hints:

If leaves are wet, place them in the magazine between sheets of paper towel to absorb the moisture.

Care must be used when handling the mounts as they are fragile and easily broken.

Step 8



Mount is completed.

**Environmental Experience 4: Tree Art**

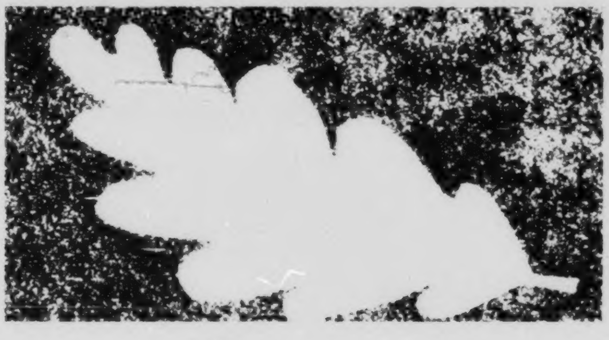
*Toothbrush Spatter Prints*

Materials:

toothbrush
paint
stick or pencil
paper
pins to hold the leaf in place

Technique:

Step 1: pin the leaf in place on the paper.
Step 2: dip the toothbrush into the paint and with the bristles up, rub the stick over the brush, working from the tip towards the handle.
Step 3: after the paint has dried, remove the leaf.



*Screen Box Spatter Prints*

Materials:

window screen
same materials as in the toothbrush technique

Technique:

Same technique as the toothbrush spatter prints except that a screen is placed over the leaf at a height of about two inches and the paint is spattered through it.

*Spray Paint Spatter Prints*

Materials:

can of spray paint
pins to hold the leaf in place

Technique:

Same technique as in the other two spatter methods, except a can of spray paint is used instead of a toothbrush.

*Smoke Prints*

Materials:

candle
wax
paper

Technique:

Step 1: Rub wax over a sheet of paper with your finger.
Step 2: Light the candle and move the paper horizontally through the flame with the waxed side down.
Step 3: After the wax has picked up a thin layer of soot, place the paper on a hard surface with the sooty side up.
Step 4: Place a leaf on the soot, vein side down, and cover with another sheet of paper.
Step 5: Rub the leaf through the top sheet of paper to pick up a coat of soot.
Step 6: Place the leaf, sooty side down, on a clean paper, and cover with another sheet of paper.
Step 7: Rub firmly but carefully so as not to move the leaf.

*Printer's Ink Prints*

Materials:

printer's ink
small rubber roller
piece of glass
printing paper and newspaper

Technique:

Step 1: Squeeze a small amount of ink onto the glass and spread into a thin layer with the roller.
Step 2: Place a leaf, vein side up, on a piece of newspaper and ink the veins with the roller.
Step 3: Place the leaf, inked side down, on a clean sheet of paper, cover with newspaper, and exert pressure.

*Ink Pad Prints*

Materials:

ink pad with ink
printing paper and newspaper

Technique:

Same technique as the printer's ink method except that the veins of the leaf are covered with ink from the ink pad.

*Blueprints*

Materials:

blueprint paper and newspaper

printing frame constructed from glass and plywood taped together.

pan with water

Technique:

Step 1: While in the shade, place the leaf and blueprint paper inside the printing frame. The order is: plywood, blueprint paper with the coated side up, leaf, glass.

Step 2: Close the frame and expose to direct sunlight until the paper turns to blue and then to gray.

Step 3: Remove the paper and place face down in a pan of water for ten minutes; the paper will again turn blue.

Step 4: Blot the paper between newspapers and dry.

Hints:

☐ Before printing, place a small rectangular paper in the right-hand corner of the blueprint paper; this area may be used for identification notes.

☐ The blueprint may be intensified by immersing in a solution of potassium bichromate (1 teaspoon per 1 gallon of water) for five minutes before final washing.

*Photographic Prints*

Materials:

photographic paper

printing frame

developing chemicals

washing pans

Technique:

Same as the blueprint method except the paper is developed using the photographic chemicals rather than water.

*Plaster Leaf Cast*

Materials:

plaster of Paris

modeling clay

rolling pin

mixing bowl for plaster

water color paints

cardboard, masking tape, or strips of wood (optional)

Technique:

Step 1: Flatten the clay into a sheet with the rolling pin.

Step 2: Place the leaf onto the clay, vein side down, and press into the clay so as to make a clear impression.

Step 3: After carefully removing the leaf from the clay, construct a frame around the impression with cardboard, wood, masking tape, or clay.

Step 4: Fill the frame and leaf impression with plaster of Paris.

Step 5: After the plaster hardens, remove the cast from the mold, allow to dry, and paint if desired

Hint:

The cast can be protected by spraying with a coat of artist's spray.

# Appendix

## TEACHER BACKGROUND INFORMATION

The following information has been gathered to help the teacher in preparation of this unit. This summary touches only lightly on the available information pertaining to trees. These materials if desired can be adapted for student use through lessons or reports. Suggestions of further topics leading from these areas are also given. Sources of further information can be found in the suggested readings.

## TREE IDENTIFICATION

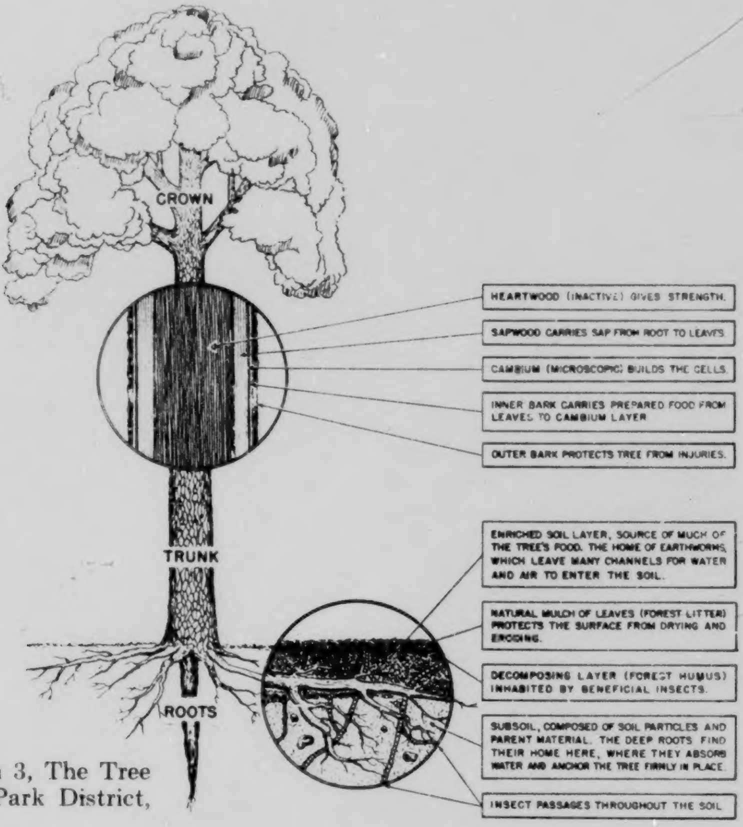
Trees form the most conspicuous feature of almost any natural landscape where they are present. All of us are aware that there are many kinds of trees and it is natural to wonder about the names of the various kinds that we see. The next step is to learn the names of these trees, and the identifying features of each.

Most of us can identify many trees in a general sort of way, such as "an oak" or "a maple." In fact, most people are surprised to learn just how many trees they do know. Try to identify one or two new ones every day or every week. It is helpful to keep a notebook on species identified. It has also been suggested that the location of a tree of each species be recorded, so that it may serve as a reference. Labeled trees in your metropolitan parks or other places may be helpful in this respect.

Identification of an unknown tree may be accomplished in one of several ways. You may ask someone who is familiar with trees to identify the tree and tell you *why* it may be so identified; you may compare it with a known or labeled specimen; or, you may work it out from a book with keys, pictures, or both. The use of a key is considered by many to be the best, for it is not necessarily so limited in scope, and the identifying features of the tree, which must be examined as you work through the key, are more easily learned. (For a list of some available tree keys see the suggested readings.)

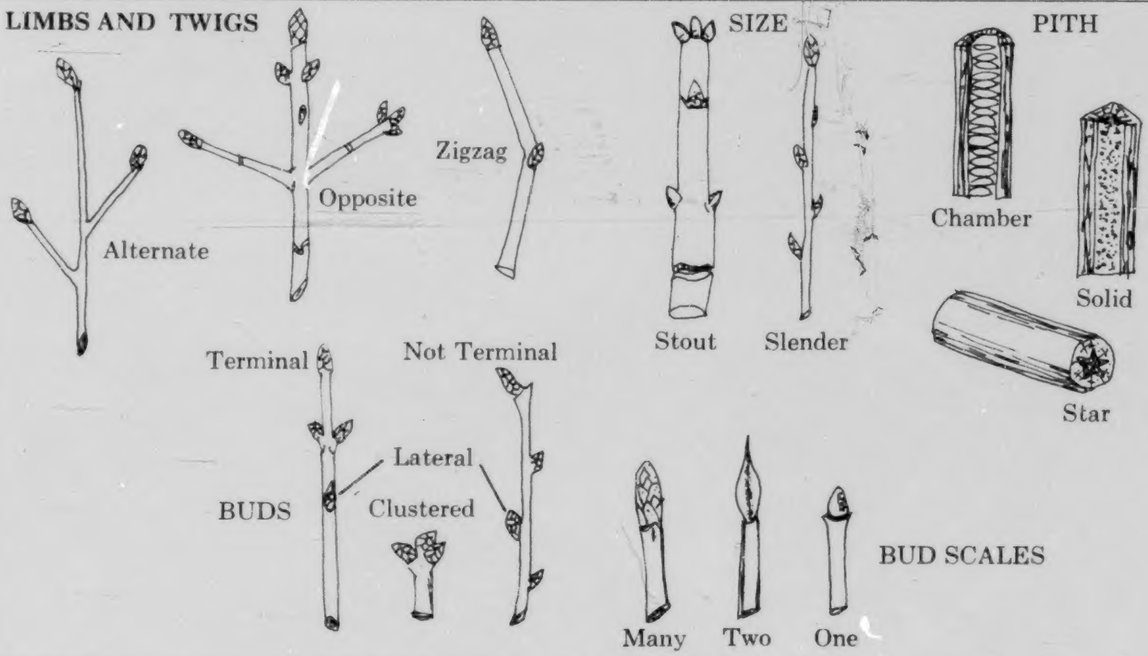
A tree can be broken down into four general parts: the trunk, roots, leaves and flowers. Each part is responsible for a different function and when the tree is free from disease and injury, they function together like parts of a machine or workers in a factory.

*Parts of Trees: Trunk* — The trunk is the central, supporting part of the tree. In cross-section, it may be seen that the trunk is made of several concentric parts. In the center is the heartwood, often darker because it contains stored materials. Next is the sapwood through which growth occurs. Finally is the outer protective layer, the bark. In the heartwood and sapwood are a series of concentric annual rings. Many trees have pith rays radiating from the center of the trunk and some have a core of pith in the center. After a little experience, one may identify many trees by the bark and general shape of the trunk.

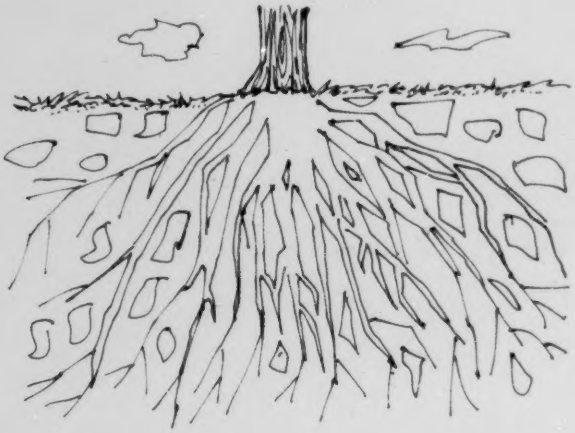

CROWN
HEARTWOOD (INACTIVE) GIVES STRENGTH.
SAPWOOD CARRIES SAP FROM ROOT TO LEAVES.
CAMBIUM (MICROSCOPIC) BUILDS THE CELLS.
INNER BARK CARRIES PREPARED FOOD FROM LEAVES TO CAMBIUM LAYER
OUTER BARK PROTECTS TREE FROM INJURIES.
TRUNK
ENRICHED SOIL LAYER, SOURCE OF MUCH OF THE TREE'S FOOD. THE HOME OF EARTHWORMS, WHICH LEAVE MANY CHANNELS FOR WATER AND AIR TO ENTER THE SOIL.
NATURAL MULCH OF LEAVES (FOREST LITTER) PROTECTS THE SURFACE FROM DRYING AND ERODING.
DECOMPOSING LAYER (FOREST HUMUS) INHABITED BY BENEFICIAL INSECTS.
ROOTS
SUBSOIL, COMPOSED OF SOIL PARTICLES AND PARENT MATERIAL. THE DEEP ROOTS FIND THEIR HOME HERE, WHERE THEY ABSORB WATER AND ANCHOR THE TREE FIRMLY IN PLACE.
INSECT PASSAGES THROUGHOUT THE SOIL.

Taken from: Park Interpretive Bulletin 3, The Tree and the Soil, Lake Co. Metropolitan Park District, Painesville, Ohio

*Limbs and Twigs* — The limbs and twigs are progressively smaller continuations of the trunk which support the leaves and flowers. The structure of limbs and twigs is similar to that of the trunk, except that in the twigs the heartwood is usually not distinguishable, and the pith often is comparatively large. The pith of some twigs may be used as an aid to identification.

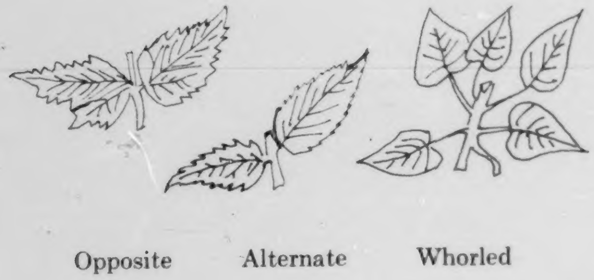

LIMBS AND TWIGS
Alternate
Opposite
Zigzag
SIZE
Stout
Slender
PITH
Chamber
Solid
Star
Terminal
Not Terminal
Lateral
BUDS
Clustered
Many
Two
One
BUD SCALES

*Roots*—Roots are underground extensions of the trunk which anchor the trees in place and serve to obtain water and minerals from the substratum on which the tree grows. Roots are seldom used in the identification of a tree.

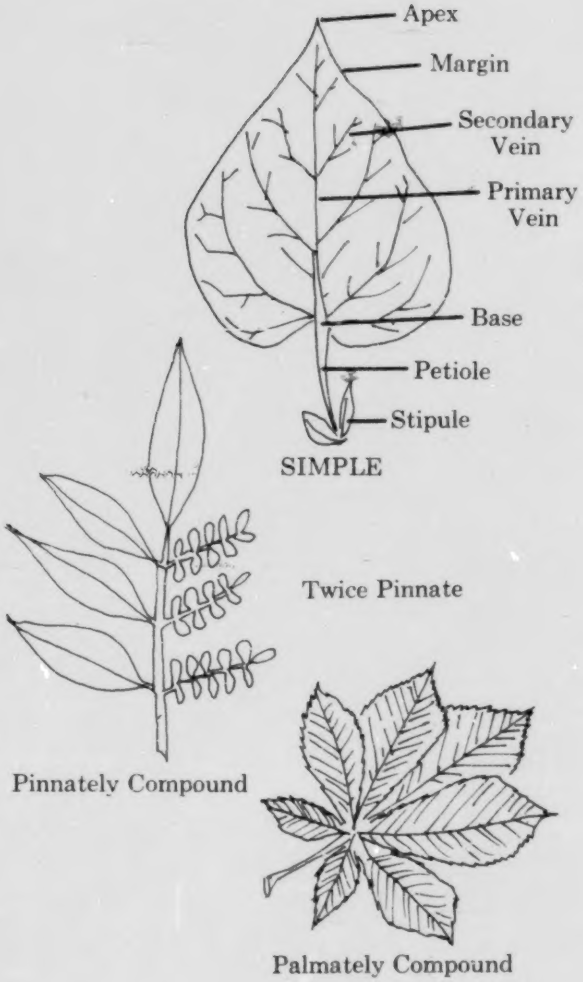


*Leaves* — Leaves are one of the most important parts of the tree, both to the tree itself and to the person studying it. Although trees can be readily identified when the leaves are absent, it is much easier to identify a tree complete with leaves. There are several characteristics of leaves which may help in identification. Are the leaves deciduous or evergreen? Opposite or alternate? Simple or compound? These and other questions must be answered before a leaf is useful in identification. A leaf may be made up of several parts, depending upon its complexity. Conifer leaves may consist of just the needles, or they may have a stalk or sheath at the base. Broad leaves usually have a petiole or stem and a blade. If the leaf is compound, the petiole may occur at the base of the stem where it attaches to the twig.

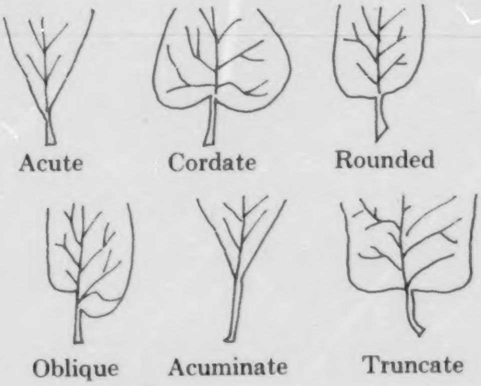
**Leaf Arrangement**


Opposite
Alternate
Whorled

**Leaf Shapes**


Apex
Margin
Secondary Vein
Primary Vein
Base
Petiole
Stipule
SIMPLE
Twice Pinnate
Pinnately Compound
Palmately Compound

**Leaf Bases**


Acute
Cordate
Rounded
Oblique
Acuminate
Truncate

---

*Leaf arrangements and leaf types by permission of the Columbus Metropolitan Park Board, 1251 East Broad St., Columbus, Ohio 43205

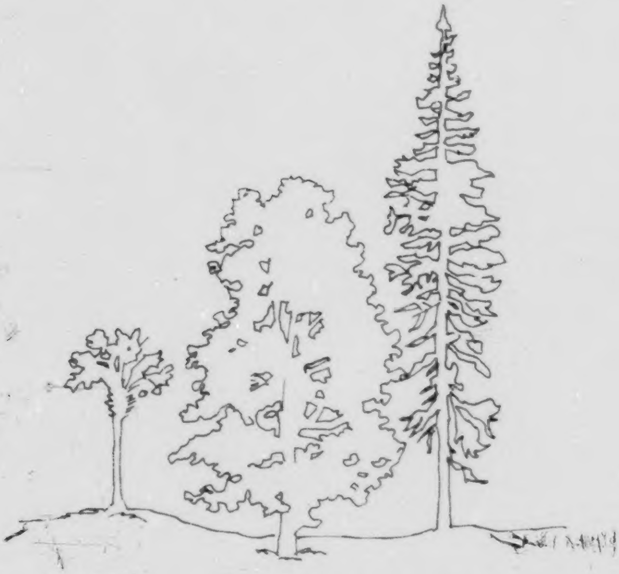
## Major Types of Trees

Basically there are three types of trees: the palms, the broadleaf trees, and the conifers.

*Conifers*—A plant that bears its seeds in cones, usually needleleaf trees. Some keep their needles all winter; these are called evergreens.

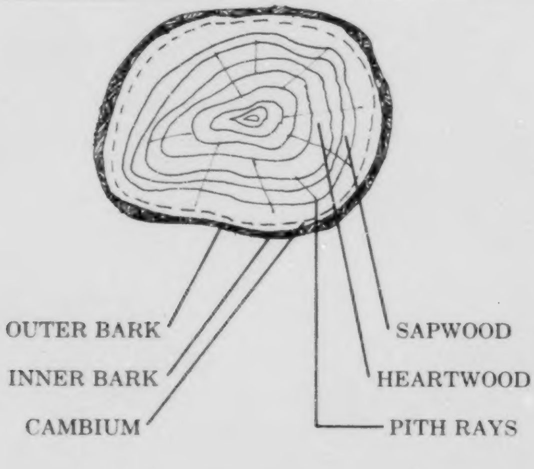
*Broadleaf Deciduous*—A plant that periodically loses all its leaves, usually in fall. Most North American broadleaf trees are deciduous. A few conifers, such as larch and cypress, are also deciduous.

*Palm*—A plant with leaves having parallel veins and growing in warm humid climates.



## Cross Section of the Trunk

The trunk of a tree performs two simple functions. It holds the crown or top of the tree erect in the sunlight and it acts as a giant pipeline to transport the food and water between the roots and the crown. There are several important parts of a tree trunk and they are located as shown in the cross-section sketch.



*Outer Bark* — This rough, corky surface acts as the skin to protect the tree from diseases and insect damage. Bark grows from the inside-out: the oldest is on the outside, the youngest is next to the wood. Annual growth rings are formed in the bark much the same as in the wood, but usually the older outside rings are pushed off or have cracked into a rough surface by the inner pressure of the growing tree.

*Inner bark* — This thin inner layer may sometimes be called part of the cambium, for it is through this thin ring of tubes that the "prepared food" from the leaves is carried to the cambium and down to the roots. To kill a tree by girdling, a ring of bark through the inner bark and cambium is removed. This cuts off the downward movement of food to the roots and prevents sprouting of new growth from the stump and the roots.

*Cambium* — In this microscopic ring the new growth takes place. The cells in the cambium keep dividing and thus add new cells to the outer ring of sapwood and to the inner layer of bark. While wood is always oldest at the inner ring, and youngest at the outer ring, the bark is oldest at the outer layer and youngest at the inner ring. The bark, inner bark, and cambium together comprise a very thin layer from ⅛" to 2" thick depending on the age and type of the tree.

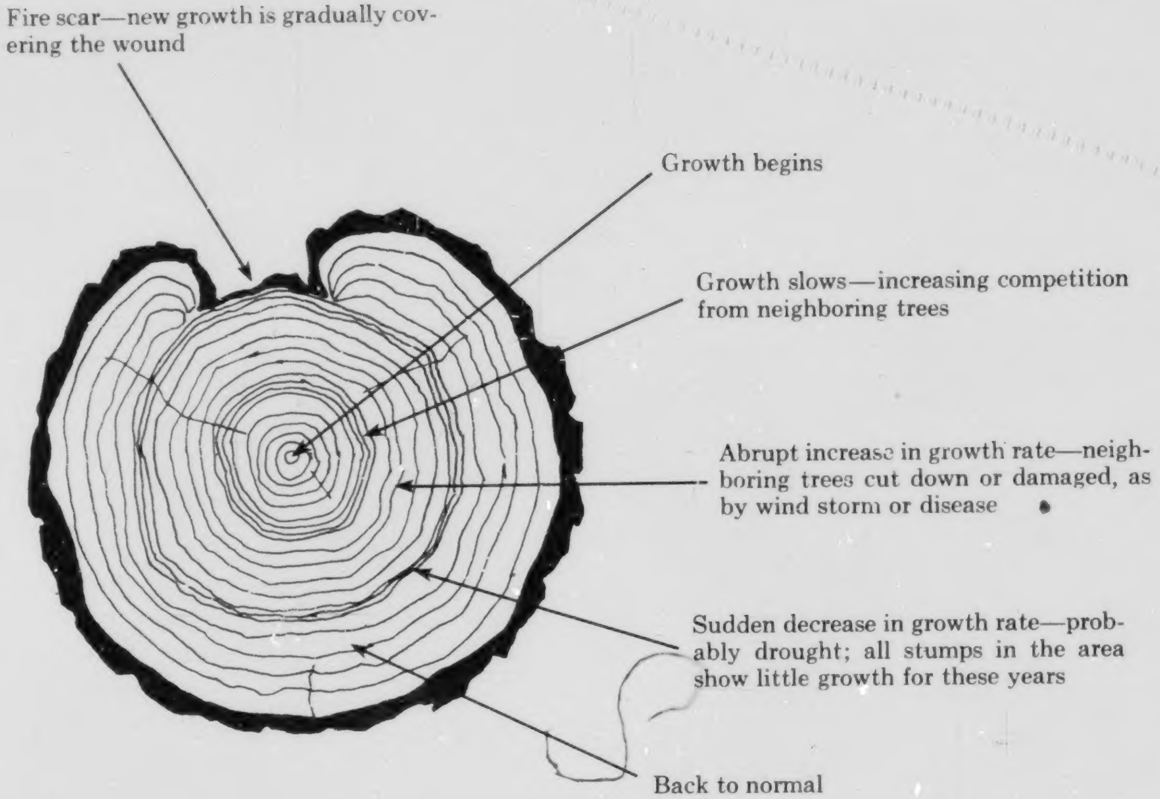
*Sapwood* — This light-colored outer ring of wood, surrounding the heartwood, is the part of the tree that carries the "sap" flowing through the roots to the various parts of the tree. The "sap" flows through the sapwood much the same as blood through the circulatory system. Sapwood may be very thin, containing only one or two annual rings, or very thick, containing up to 100 rings.

*Heartwood* — The sapwood over a period of time slowly ceases to be part of the active or living part of the tree. This comes about by the continual formation of the new sapwood in the outer rings. In other words, it changes from living or "sap" wood into dead or "heart" wood. Heartwood, the innermost section of the tree, is usually darker in color and denser, and is the storehouse for the various gums, resins, and deposits which are responsible for its being more durable. Good examples of heartwood are found in black-locust, red cedar, black walnut and white oak.

*Pith rays* — The lines that seem to run across the trunk section from the bark to the heartwood are in reality sheets of plant tissues that bind the rings together and serve as pipe lines to transfer foods to the stems.

Various things can be learned from the cross-section of a tree. Age can be determined by the number of growth rings. The distance between rings is an index to the weather conditions of the past. The science of dating events and variations in the environment in former periods by comparative study of growth rings in trees and aged wood is called dendrochronology.

**Environmental Conditions:**



Fire scar—new growth is gradually covering the wound

Growth begins

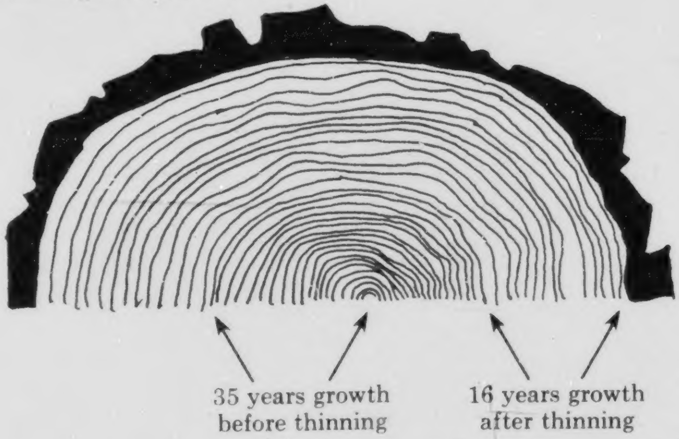
Growth slows—increasing competition from neighboring trees

Abrupt increase in growth rate—neighboring trees cut down or damaged, as by wind storm or disease

Sudden decrease in growth rate—probably drought; all stumps in the area show little growth for these years

Back to normal

Thinning Increases Growth



35 years growth before thinning

16 years growth after thinning

**Bark**

A. Function and Appearance — A tree has four main parts: the roots, the trunk with its branches, the leaves and the flowers. The trunk has a dense core of heartwood that gives it strength. Surrounding that is a layer of sapwood. On the outside is a layer of bark. The bark protects the wood against attack of fungi and, most important, it protects the cambium, a microscopically thin layer of wonder-working cells between the sapwood and the bark. If a tree is "girdled" — its wood exposed by removing a band of bark around the trunk -- the cambium dries and the tree dies.

The cambium enables a tree to live and grow in width. Each year it builds another layer of sapwood, and also a layer of bark. The sapwood conducts water and dissolved minerals taken from the soil by the roots, up through the trunk and branches to the leaves. Food manufactured by the leaves is carried down to the trunk and roots through the spongy sieve-like inner bark. As new layers of wood and bark are added, the older growths of bark are pushed outward. They become dry and hard. Eventually they become loose and drop off.

In each species the bark on the older trees has a distinctive appearance. Even during winter, many of our hardwoods can be identified by the color of the bark, and whether it is smooth, ridged, deeply furrowed, scaly, or shaggy. The beech, the paper or canoe birch, both hornbeams, the sycamore, hackberry, white oak, bur oak, black cherry, and shagbark hickory are familiar examples. On some trees, the bark is rather thin; on others such as a bur oak, it may be 2 inches thick; on a gigantic sequoia the deeply wrinkled bark, spongy and fire resistant, frequently has a total thickness of 2 feet.

B. Uses of Tree Bark — Our American Indians had some use for one or more parts of almost every plant, including the bark of trees and shrubs. Sheets of bark peeled from the paper birch were used to cover Ojibue wigwams and canoes. It was used to make all sorts of baskets, buckets, trays and vessels for gathering, cooking and storing foods. The Potawatomi commonly used elm bark to make utensils and cover their wigwams. Both tribes used fibers from the inner bark or bast of the linden (basswood) for cordage and weaving. For various medicines they used bark from hemlock, tamarack, pine, spruce, black and choke cherries, poplars, willows, slippery elm, speckled alder and buckthorn. They made dyes from the barks of sumac, speckled alder, birch, oaks, hemlock, willows, and wild plum.

Marco Polo told how, in the 13th century, the Mongols made paper money out of the inner bark of the paper mulberry, now used in Japan for making paper and in the South Sea Islands for tapa cloth. Cinnamon, the aromatic inner bark of evergreen trees native in Ceylon and India, has been prized for centuries as a spice and as an ingredient in perfumes and incense. For tanning leather we have used, since Colonial times, the astringent barks of chestnut, oaks, and hemlock; now largely supplanted by quebracho bark from Argentina and Paraguay. The bark of cinchona trees, native in Peru, furnished quinine.

Cork, an extremely light, buoyant substance which has many important uses, is obtained in Portugal from the outer bark of the Mediterranean cork oak. During World War II, the bark of Douglas fir was found to be valuable for many purposes and is no longer wasted. The thick shaggy bark of our California redwoods is now utilized as material for insulation, floor cleaners, and as a substitute for wool in fabrics.

**Hollow Trees**

You may have heard the expression "They couldn't see the forest for the trees." There was a time, especially in Germany, when foresters grew trees as farmers grow cabbages: thousands of acres covered with just one kind planted in long rows that were kept free of all seedlings, underbrush, dead or injured trees. Nothing but perfect specimens were allowed. These plantations produced astonishing yields of lumber and the Germans boasted of them as models of "efficiency." The fact that they supported practically no wildlife — only a few birds, no food for deer, and so forth — was contemptuously dismissed.

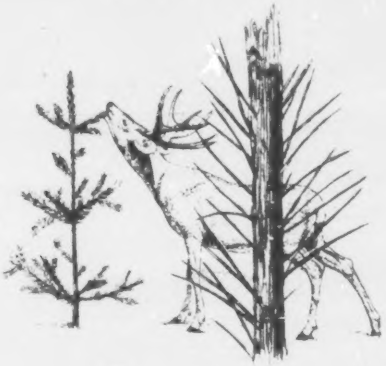
Suddenly the soil turned "sick." Insect pests swept through them like forest fires. They withered and died. Finally the Germans turned to the planting of mixed forests, including "worthless" species such as beech and birch, where natural reproduction and undergrowth were permitted. They put up nesting boxes to attract the many kinds of birds that help control harmful insects. They actually imported and propagated some species, including owls. They planted earthworms in the soil. They found that woodlands which comprise a natural community of a great variety of living things are more productive and give less trouble than artificial plantings. They became apostles of the Naturschutz — a natural forest. We now know that wildlife is valuable for more than meat and fur, or to provide sport for the hunter, or as something sacred to the long-haired few who write sentimental essays and poems about "naytchah."

Some of the most useful, valuable and interesting animals of our American woodlands are missing when there are no trees with dead limbs or hollow trunks. Honey bees and wasps, butterflies, moths, mosquitoes, spiders, snails, tree frogs, and many other kinds of lower animals and fungi are found in such places. A list of some of the higher animals that nest, den or find shelter there, and perhaps food, includes: raccoon, possum, deer mouse, the brown creeper, bluebird, three kinds of wrens, crested flycatcher, prothonotary warbler, chimney swift, purple martin, tree swallow, starling, house sparrow, screech owl, barn owl, barred owl, sparrow hawk, and many kinds of ducks — wood duck, bufflehead, American goldeneye, Barrow's goldeneye, fulvous and black-bellied tree ducks, hooded merganser and American merganser.

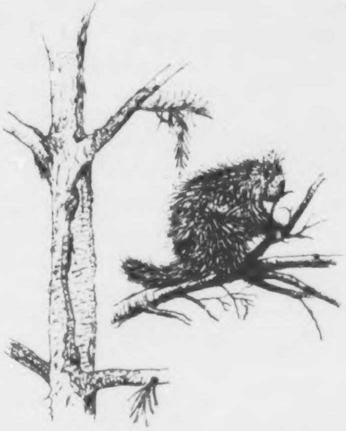
A good way to learn what lives in such trees is by sauntering through the woods in winter. Squirrels prefer the holes made when a small limb is broken off and decays back into the trunk. Woodpeckers drill holes in dead limbs and excavate a nest cavity which is frequently used the next year by other kinds of birds. One day we spied some chunks of honeycomb at the foot of a tall red oak in the woods back of Punkin Knob. Deer mice are fond of honey and sometimes rob a hive in midwinter. Sure enough, on the next balmy sunny day there were bees streaming in and out of a hole up on the trunk of that tree. Not far from there is a hollow linden where possums and a family of flying squirrels have their dens. Farther on, there is a big soft maple on the bank of a small creek. Leading to it, in the snow, we have seen raccoon tracks and, on the bark, their claw marks and a few hairs. That must be the varmint that scared our "missus" half to death when he stuck his head up out of the garbage barrel.

Adapted and reprinted by permission of the Forest Preserve District of Cook County, Illinois, Bulletin 594, March, 1960.

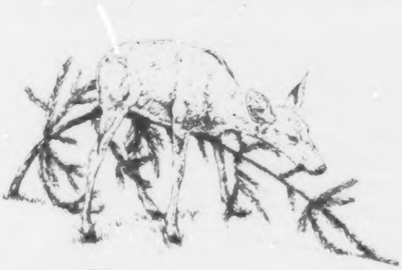
**Animal Signs**
Reproduced by permission of McGraw-Hill, from *The Life of The Forest* by Jack McCormick, 1966.



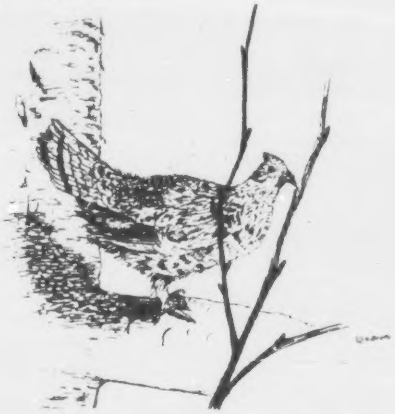
Deer, elk, and moose leave splintered breaks on woody stems in winter and blunt breaks in spring and summer when the twigs are soft and swollen.



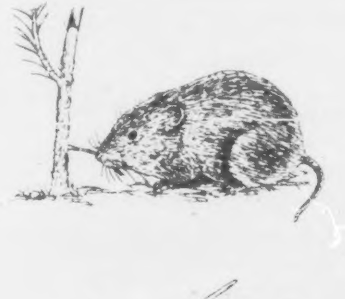
Porcupines eat large sections of bark from trees. Frequently they attack pine trees, and their large tooth marks are clearly visible.



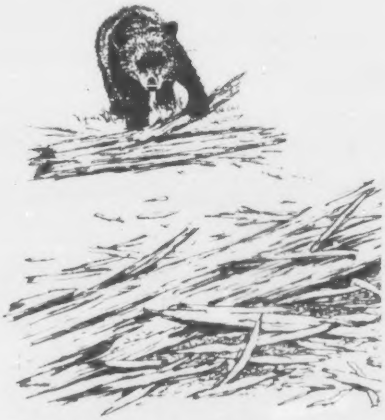
Deer, elk, and moose "ride down" small trees and nibble the tender shoots from their tops. When the trees spring back upright, the eaten areas are higher than these browsers could normally reach.



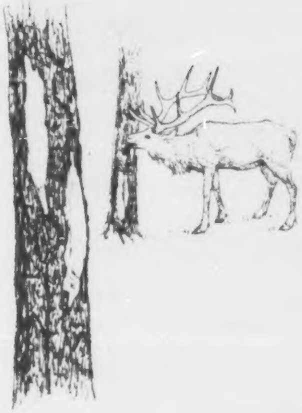
Ruffed grouse pick off the tender buds of small saplings without damaging the twigs.



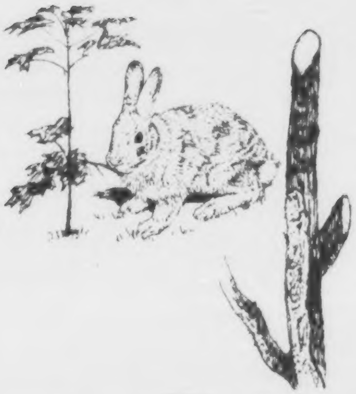
Meadow mice feed on small branches and stems. They leave small conical cut ends that resemble miniature beaver cuttings.



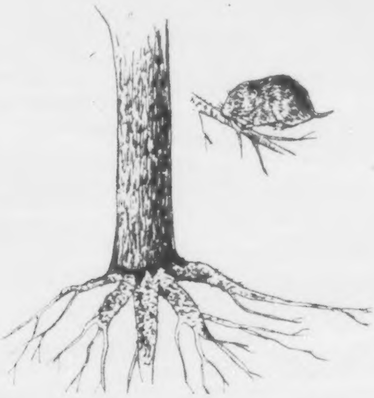
Bears tear dead logs and stumps apart to find ants. They leave splintered holes in the log and scatter long fragments of pawed-over trunk.



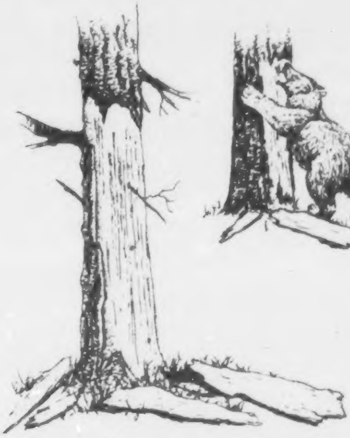
Browsers also peel bark from tree trunks. The strips of bark, which are pulled upward from the trunk, taper to a narrow point before breaking off.



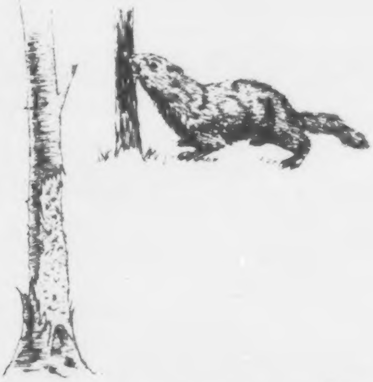
Rabbits leave on twigs smooth, slanting cuts which resemble knife cuts. Their tooth marks usually appear as narrow grooves where the twig has been clipped.



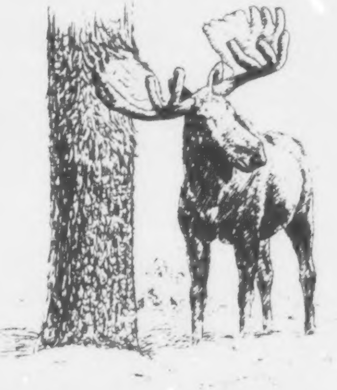
Pine mice chew irregular patches from root collars and undersides of roots of trees and shrubs. If the mice feed over several winters, the leaves may become discolored and the winter buds smaller than normal.



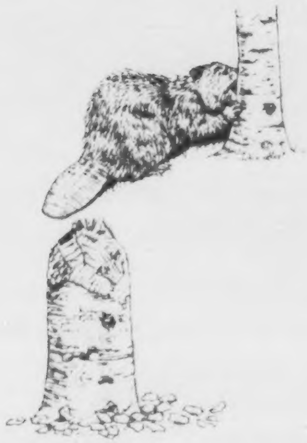
Bears leave territorial signs on trees by clawing and by slashing with their teeth long vertical gashes on the trunks. Strips of bark heaped at tree bases indicate "bear trees."



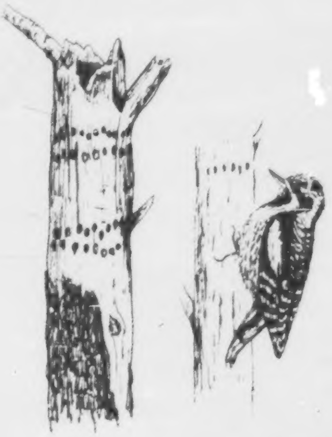
For reasons not clearly understood, woodchucks gnaw bark on stems and at the bases of small saplings near their dens and thus produce irregular patchy gnawed areas.



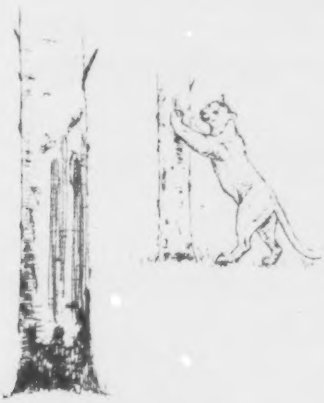
Moose, elk, and deer scrape the velvet from their antlers by rubbing them against tree trunks; the bark of the tree is left hanging in shreds.



Beavers gnaw through trunks and large branches. The conical stumps they leave have pronounced channels made by their large incisor teeth.



Yellow-bellied sapsuckers and their relatives drill lines of small holes around tree trunks and drink the sap that flows out.



Mountain lions sharpen their laws on tree trunks much as house cats do and leave long vertical scratches.

## Don't Give Jack Frost All the Credit

Changes are taking place all around us during the autumn season. It is the time of the year when the crops stand ripe in the fields and we can view some of the most beautiful landscape painting ever made. Set against a background of blue sky, the multi-colored Ohio woodlands take on a new and inviting aspect of beauty present only at this time of the year. How often have we heard that this panorama is caused by the work of Jack Frost? Jack Frost hasn't been around too much and still we have the autumn color changes — why?

Leaves, plant cells and tissue of trees would be colorless or transparent if they didn't have certain color pigments. The color pigments in the leaves of the majority of our trees are green (chlorophyll), yellow (xanthophyll), and orange (carotin). The red pigment (anthocyan) is present in some leaves. The various shades of green present in the summer foliage are caused by the combination of two different types of chlorophyll, one of which is blue-green and the other yellow-green. During the growth process, chlorophyll is continually being destroyed, but new chlorophyll is made to replace the chlorophyll that is destroyed. Chlorophyll is produced in a part of a plant cell called the chloroplast. However, the chloroplast can produce chlorophyll (green) only in the presence of light, while xanthophyll (yellow) and carotin (orange) can be produced in the dark.

Lack of light is not the only factor that retards the manufacture of chlorophyll. Other conditions such as low temperature, drought, insect infections, injuries and diseases can slow down or stop the production of new chlorophyll. As Autumn approaches, the days get shorter, providing less light for the manufacturing of chlorophyll. Along with the loss of sunlight, the temperature and other conditions become less favorable for the plant to produce chlorophyll. With more chlorophyll being destroyed than produced, yellow, orange, and red pigments become more predominant in the leaves.

Various types of trees contain amounts of the color pigments. Thus each type of tree has a tendency to be of a specific color: sumac is red, the aspen is yellow, the maples tend to be orange, and so on. One specific tree may vary somewhat in fall coloration from year to year due to the difference in the weather and other conditions. The brilliance or the intensity of the color is determined largely by the weather and other conditions. A brilliant red color is more prevalent when the temperature is moderately low and we have bright sunny days. Dull colors in our fall foliage are apt to be caused by warm, cloudy autumns. Yellow is the predominant color under these conditions.

The yellows are the first colors to appear in the fall. The first splashes of yellow in late August and early September mean the approach of autumn to most people. The red color arrives next, presenting a never-to-be-forgotten beauty and mood to the wooded Ohio countryside.

It is strange, but perhaps nature has given us a giant set of safety signals for the protection of our forests from the destruction brought on by fire. When the forest is green all is safe. The appearance of yellow means caution! the fire danger season is approaching. When the reds appear there is real danger! the fire season has arrived. We should all heed the safety code of the woods.

Courtesy Columbus Metropolitan Park Board.

## STATE TREES AND ARBOR DAYS

| *State:* | *State Tree:* | *Arbor Day:* |
|---|---|---|
| Alabama | "Southern Pine" | Second Friday in February |
| Alaska | Sitka Spruce | None |
| Arizona | Palo Verde | Friday after February 1st |
| Arkansas | Shortleaf Pine | First Saturday in December |
| California | Redwood | March 7th |
| Colorado | Blue Spruce | Third Friday in April |
| Connecticut | White Oak | Last Friday in April |
| Delaware | American Holly | Day designated by the Governor |
| Florida | Sabal Palm | Third Friday in January |
| Georgia | Live Oak | Third Friday in February |
| Hawaii | Kukui | Unknown |
| Idaho | White Pine | Designated by State Board of Education |
| Illinois | "Native Oak" | Last Friday in April |
| Indiana | Tuliptree | Last Friday in April |
| Iowa | None | By proclamation of the Governor |
| Kansas | Cottonwood | Last Friday in March |
| Kentucky | Tulip-Poplar | By proclamation of the Governor |
| Louisiana | Magnolia | Designated by State & Parish Bds. of Ed. |
| Maine | White Pine | Last Friday in April |
| Maryland | White Oak | Designated by State Board of Education |
| Massachusetts | American Elm | Last Friday in April |
| Michigan | White Pine | By proclamation of the Governor |
| Minnesota | Red Pine | By proclamation of the Governor |
| Mississippi | Magnolia | Friday after first Monday in December |
| Missouri | Flowering Dogwood | Friday after first Tuesday in April |
| Montana | Western Yellow Pine | Second Tuesday in May |
| Nebraska | American Elm | April 22nd (Legal holiday) |
| Nevada | Pinon Pine | Last Friday in April |
| New Hampshire | White Birch | Designated by the Governor |
| New Jersey | Red Oak | Last Friday in April |
| New Mexico | Pinon Pine | Second Friday in March |
| New York | Sugar Maple | Designated by Commissioner of Education |
| North Carolina | None | Friday after March 15th |
| North Dakota | American Elm | First Friday in May |
| Ohio | Ohio Buckeye | Last Friday in April |
| Oklahoma | Redbud | Friday after second Monday in March |
| Oregon | Douglas Fir | Second Fri. in Feb. west of Cascades; second Fri. in April east of Cascades |
| Pennsylvania | Eastern Hemlock | April 9, provided not Sat., Sun. or Good Fri. |
| Rhode Island | Maple | Last Friday in April |
| South Carolina | Palmetto | First Friday in December |
| South Dakota | Black Hills Spruce | Last Friday in April |
| Tennessee | Tulip Poplar | First Friday in March |
| Texas | Pecan | Third Friday in January |
| Utah | Blue Spruce | By proclamation of the Governor |
| Vermont | Sugar Maple | By proclamation of the Governor |
| Virginia | Dogwood | Second Friday in March |
| Washington | Western Hemlock | By proclamation of the Governor |
| West Virginia | Sugar Maple | By proclamation of the Governor |
| Wisconsin | Sugar Maple | Last Friday in April |
| Wyoming | Cottonwood | By proclamation of the Governor |

Taken from: *Audubon Tree Study Program, Guide for Adult Leaders* by Shirley Miller, National Audubon Society.

**Famous Historical Trees**

Do you have any in your area?

*Bristlecone Pine* (Inyo National Forest in the White Mountains, California): Scientists tell us that this gnarled old tree is the oldest living thing on earth. They estimate its age as 4600 years, which means it started life when the Egyptian Pyramids were being built. It stands in a grove with seventeen other bristlecone "Methuselahs," each of which has lived over 4000 years.

*Charter Oak,* (Hartford, Conn.): The Charter of the Connecticut colony, granted by King Charles II in 1662, was hidden in a hole in this white oak by a patriot when Sir Edmund Andros demanded its surrender in 1687. A storm destroyed the Charter Oak in 1856 and it was mourned by tolling bells.

*De Soto Oak* (University of Tampa, Florida): It is said that DeSoto signed a treaty with the Indians here in 1539. During the Spanish-American War, Theodore Roosevelt waited under its branches for orders to sail to Cuba.

*Dueling Oak* (New Orleans, La.): Many affairs of honor were settled by sword and pistol under it, from early Creole days to 1890.

*Evangeline Oak* (Saint Martinsville, La.): According to legend, the Acadian girl whose constancy inspired Longfellow's poem "Evangeline," was reunited with her childhood sweetheart under this live oak after years of wandering in exile.

*Founders Tree* (Humboldt Redwoods State Park, Calif.): Believed to be the world's tallest tree, this 364′ giant redwood (Sequoia sempervirens) has been dedicated to the three founders of the Save-the-Redwoods League: Madison Grant, John C. Merriam and Henry Fairfield Osborn.

*General Sherman Tree* (Sequoia National Park, Calif.): Although its 272′ height does not equal that of the Founders Tree, this other species of redwood (Sequoia gigantea) is thought to be the largest living tree in the world. It weighs 6000 tons and has a volume of 600,000 board feet — enough to build 80 five-room houses.

*Liberty Tree* (St. John's College, Annapolis, Md.): A treaty with the Susquehannock Indians was signed under it in 1652. During the American Revolution patriots met under it, thus giving it its name.

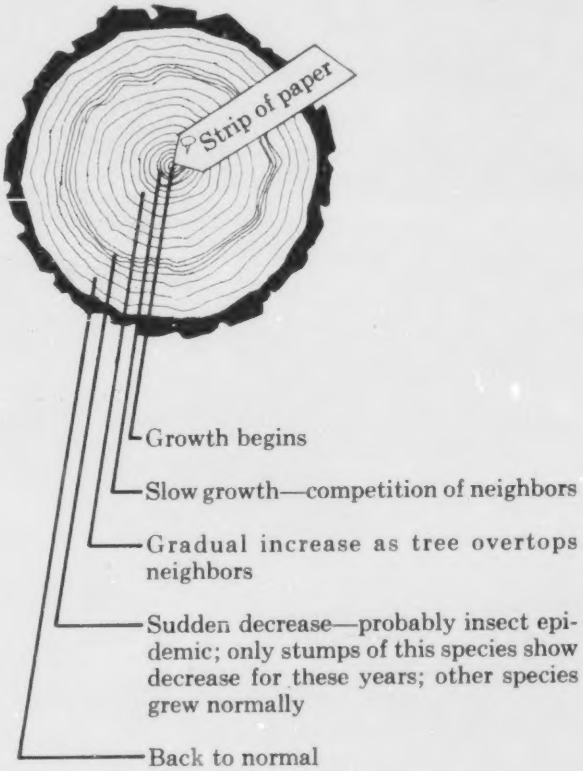
*Post Office Oak* (Council Grove, Kansas): A cavity at its base served as a post office for thousands of cowboys and soldiers from 1825 to 1847. It was also the birthplace of the Santa Fe Trail.

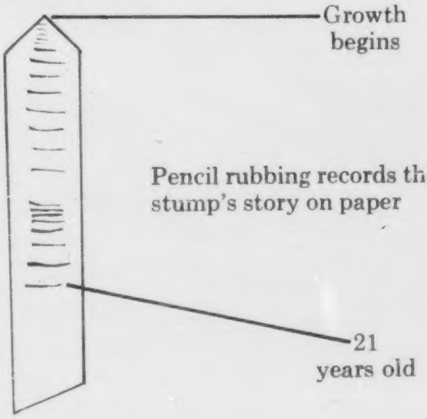
*Treaty Live Oak* (Jacksonville, Florida): Indians held many pow-wows under this great tree, and it has been estimated that 4000 people could stand within its shade at high noon.

Taken from: *Audubon Tree Study Program, Guide for Adult Leaders* by Shirley Miller, National Audubon Society.

**History from a Tree Stump**

Find a tree stump with clearly visible growth rings. Using a strip of paper and a soft pencil rub the pattern of rings onto the strip. Determine its relative age. A deciduous tree usually adds only one growth ring per year. Research the history of the area. Were there any fires, or insect or disease plagues in the past? Write a history for your tree, complete with inhabitants and events that might have taken place under your tree.


Strip of paper
Growth begins
Slow growth—competition of neighbors
Gradual increase as tree overtops neighbors
Sudden decrease—probably insect epidemic; only stumps of this species show decrease for these years; other species grew normally
Back to normal



Pencil rubbing records the stump's story on paper

## FOREST AREAS OF OHIO, BY COUNTIES

| County | Total land area | Nonforest land area | Forest land area | County | Total land area | Nonforest land area | Forest land area |
|---|---|---|---|---|---|---|---|
| | *1,000 acres* | *1,000 acres* | *1,000 acres* | | *1,000 acres* | *1,000 acres* | *1,000 acres* |
| Adams | 375.9 | 188.8 | 187.1 | Licking | 439.0 | 375.1 | 63.0 |
| Allen | 262.1 | 246.9 | 15.2 | Logan | 294.5 | 268.0 | 26.5 |
| Ashland | 271.1 | 226.1 | 45.0 | Lorain | 316.7 | 271.8 | 44.9 |
| Ashtabula | 448.1 | 326.4 | 121.7 | Lucas | 219.8 | 198.2 | 21.6 |
| Athens | 322.6 | 104.8 | 217.8 | Madison | 297.0 | 286.8 | 10.2 |
| Auglaize | 255.9 | 241.2 | 14.7 | Mahoning | 265.7 | 209.6 | 56.1 |
| Belmont | 342.0 | 183.7 | 158.3 | Marion | 259.1 | 246.8 | 12.3 |
| Brown | 313.9 | 237.1 | 76.8 | Medina | 271.8 | 224.4 | 47.4 |
| Butler | 301.2 | 263.3 | 37.9 | Meigs | 278.7 | 110.6 | 168.1 |
| Carroll | 249.9 | 136.1 | 113.8 | Mercer | 290.7 | 275.7 | 15.0 |
| Champaign | 276.5 | 255.7 | 20.8 | Miami | 260.3 | 248.9 | 11.4 |
| Clark | 257.3 | 244.4 | 12.9 | Monroe | 291.8 | 108.0 | 183.8 |
| Clermont | 293.3 | 202.3 | 91.0 | Montgomery | 293.4 | 274.3 | 19.1 |
| Clinton | 262.5 | 243.5 | 19.0 | Morgan | 268.5 | 151.2 | 117.3 |
| Columbiana | 341.6 | 243.3 | 98.3 | Morrow | 258.1 | 224.7 | 33.4 |
| Coshocton | 359.6 | 211.2 | 148.4 | Muskingum | 427.0 | 251.4 | 175.6 |
| Crawford | 258.6 | 236.5 | 22.1 | Noble | 255.0 | 139.3 | 115.7 |
| Cuyahoga | 291.8 | 250.1 | 41.7 | Ottawa | 167.3 | 159.7 | 7.6 |
| Darke | 387.1 | 364.7 | 22.4 | Paulding | 266.9 | 248.6 | 18.3 |
| Defiance | 263.7 | 236.1 | 27.6 | Perry | 262.1 | 129.2 | 132.9 |
| Delaware | 287.7 | 266.4 | 21.3 | Pickaway | 324.5 | 310.4 | 14.1 |
| Erie | 168.8 | 149.0 | 19.8 | Pike | 283.6 | 114.2 | 169.4 |
| Fairfield | 323.0 | 286.3 | 36.7 | Portage | 316.6 | 221.6 | 95.0 |
| Fayette | 259.8 | 252.5 | 7.3 | Preble | 273.5 | 249.4 | 24.1 |
| Franklin | 344.1 | 326.9 | 17.2 | Putnam | 311.0 | 295.8 | 15.2 |
| Fulton | 260.3 | 242.8 | 17.5 | Richland | 317.2 | 263.3 | 53.9 |
| Gallia | 301.4 | 142.3 | 159.1 | Ross | 439.6 | 269.3 | 170.3 |
| Geauga | 260.5 | 174.6 | 85.9 | Sandusky | 261.9 | 246.9 | 15.0 |
| Greene | 265.8 | 246.5 | 19.3 | Scioto | 389.2 | 129.5 | 259.7 |
| Guernsey | 337.7 | 182.3 | 155.4 | Seneca | 352.6 | 328.9 | 23.7 |
| Hamilton | 265.1 | 219.6 | 45.5 | Shelby | 261.1 | 238.1 | 23.0 |
| Hancock | 340.3 | 317.1 | 23.2 | Stark | 368.3 | 326.3 | 42.0 |
| Hardin | 298.9 | 281.7 | 17.2 | Summit | 262.7 | 203.9 | 58.8 |
| Harrison | 256.6 | 117.9 | 138.7 | Trumbull | 393.4 | 294.0 | 99.4 |
| Henry | 265.9 | 254.7 | 11.2 | Tuscarawas | 364.2 | 207.9 | 156.3 |
| Highland | 351.4 | 267.2 | 84.2 | Union | 277.8 | 259.6 | 18.2 |
| Hocking | 269.4 | 71.0 | 198.4 | Van Wert | 261.8 | 252.3 | 9.5 |
| Holmes | 271.1 | 177.6 | 93.5 | Vinton | 262.7 | 66.8 | 195.9 |
| Huron | 318.0 | 273.0 | 45.0 | Warren | 261.1 | 231.8 | 29.3 |
| Jackson | 267.9 | 126.3 | 141.6 | Washington | 410.2 | 159.1 | 251.1 |
| Jefferson | 262.8 | 114.6 | 148.2 | Wayne | 358.9 | 311.5 | 47.4 |
| Knox | 339.9 | 276.5 | 63.4 | Williams | 269.3 | 241.7 | 27.6 |
| Lake | 148.0 | 104.6 | 43.4 | Wood | 396.3 | 383.0 | 13.3 |
| Lawrence | 291.5 | 83.4 | 208.1 | Wyandot | 259.8 | 241.4 | 18.4 |
| | | | | ALL COUNTIES | 26,251.3 | 19,846.0 | 6,405.3 |

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Bragdon, Lillian. *Luther Burbank, Nature's Helper.* Nashville: Abingdon, 1959.

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Smith, Agnes. *An Edge of the Forest.* New York: Viking Press, 1959.

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Forest Service Films. Send for a catalog listing 73 general-interest 16 mm. films and 27 training films. They are in black and white and color and are available for free loan to schools. Forest Service, Department of Agriculture, Washington, D. C. 20250.

*A Plant Through the Seasons (An Apple Tree),* 11 min., Color, B/W, Encyclopedia Britannica Educational Corporation, 425 N. Michigan Ave., Chicago, Ill. 60611.

*A Tree is a Living Thing,* 11 min., Color, B/W, Encyclopedia Britannica Educational Corporation, 425 N. Michigan Ave., Chicago, Ill. 60611.

*Seasonal Changes in Trees,* 11 min., Color, B/W, Coronet Films, 65 E. South Water Street, Chicago, Ill. 60601.

*Trees—How We Identify Them,* Color, B/W, Coronet Films.

*Trees Grow Through the Years,* Color, B/W, Coronet Films.

*What Is A Tree?* 7 min., Color, ACI Films, Inc., 35 West 45th St., New York, N. Y. 10036.

### Other Useful Materials

#### Charts and Posters

Forest Service, U. S. Department of Agriculture, Washington, D. C. 20250.

- *How Fire Ruins Timber* (8x10½")
- *How A Tree Grows and The Tree and The Soil* (8x10½")
- *What We Get From Forest Lands* (15x21")
- *Forest Regions of the United States* (18x21")
- *What We Get From Trees* (40x28")
- *Smokey Bear—Forest Fire Prevention* (13x18½")

*Audubon Tree Chart,* National Audubon Society, 950 Third Ave., New York, N.Y. 10028.

#### Packets, Kits, and Activity Books

*Forestry Activities, A Guide for Youth Group Leaders,* U. S. Department of Agriculture, Forest Service, Washington, D. C., Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.

*The National Forests: Lands of Many Uses,* Youth Group Packet Forest Service—U. S. Department of Agriculture, Superintendent of Documents, U. S. Government Printing Office, Washington, D. C.

*The Story of Trees for Audubon Juniors,* Miller, Shirley, A Program of the National Audubon Society, 950 Third Ave., New York, N. Y.

Teacher's Forest Fire Prevention and Conservation Kit, Forest Service; U. S. Department of Agriculture, Northeastern Area (S&PF), 6816 Market Street, Upper Darby, Pennsylvania 19080.

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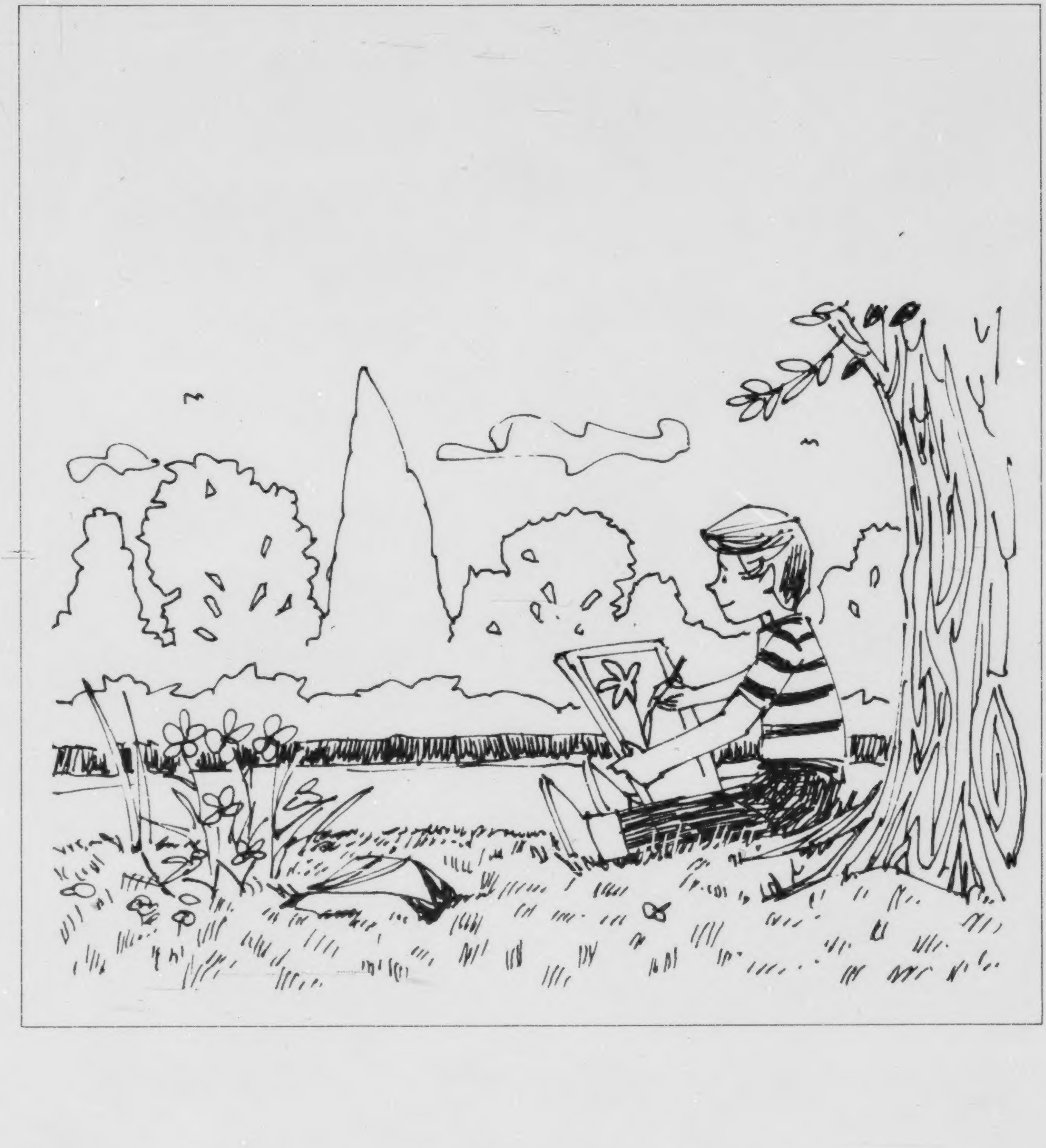
*Ohio's Tree Country.* Ohio Department of Natural Resources, Division of Forestry and Reclamation.

Ohio Department of Natural Resources: Columbus Office, Belcher Drive, Fountain Square, Columbus,

Ohio. District 2 Office, 952 Lima Avenue, Findlay, Ohio 45840. District 3 Office, 1888 E. High Avenue, Ext., New Philadelphia, Ohio 44663. District 4 Office, 360 East State Street, Athens, Ohio 45701. District 5 Office, 345 Allen Avenue, Chillicothe, Ohio 45602.

*Trees of the Forest: Their Beauty and Use.* U. S. Department of Agriculture Forest Service. Superintendent of Documents, U. S. Government Printing Office, Washington, D. C. 20402.



# Wild Ideas with Wild Plants

The study of wild plants can be an enjoyable and rewarding addition to the school curriculum for both the students and the teacher. Wild plants, next to soil, are one of the most readily available resources for study. Wild plants can be found not only in rural and suburban areas but also in the heart of the inner-city, in vacant lots, and between cracks in the pavement. A unit dealing with the appreciation and identification of wild plants and their place in nature offers a starting point for a more detailed study of plant life, care of plants, cultivated plants and animal life. While the unit offers instructions for the collecting and mounting of plants, the idea of conservation of and the extinction of wild plants is stressed. Ideas from this unit may be used to supplement your regular science or social science lesson. It also offers motivation for the study of the environment.

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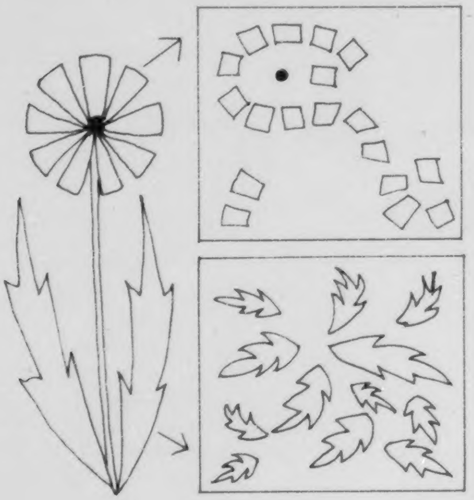
## WILD IDEAS WITH WILD PLANTS

**Unit Objectives:**

The student will be able to
1. identify the artistic and structural patterns found in a variety of wild plants.
2. discuss the conservation of wild plants and his part in their conservation.
3. describe the differences in a variety of wild plants.
4. construct and use a wild plant press.
5. collect, identify, and mount some wild plants.
6. discuss the uses of wild plants and man's dependence on them.
7. relate his reactions to wild plants.

### Environmental Experience 1: Artistic Pattern in Wild Plants

Wild plants come in every size, shape, color and form. They grow in parks, woods, vacant lots, and even gardens and yards, adding beauty and pleasure with their fragrant flowers and luxuriant foliage. The patterns they create in a field or an open lawn have been the subject of many paintings. Even individual flowers and leaves have patterns all their own. Many of the patterns can resemble geometric forms such as squares, circles, stars, rectangles, and many others, or they can form irregular but common patterns. Take your class for a walk in the woods or school lawn looking for as many geometric or irregular patterns as you can find. Have each child pick one pattern and draw it or remember it. Once back in the classroom, have the children cut their patterns out of one of many colors of colored paper and arrange their pattern pieces to form a geometric design. Display their work in a hall or classroom.



*Materials*

Colored paper
Pencils
Scissors
Paste
Paper suitable for background
Tablet paper for field drawings

### Environmental Experience 2: Structural Patterns in Wild Plants

Wild plants have been commonly called wildflowers or weeds. Webster defines the wildflower as "the flower of a wild or uncultivated plant or the plant bearing it." He defines a weed as "a plant of no value or use that tends to over-grow or choke out more desirable plants." Discuss the difference between a weed, a wildflower, and a cultivated plant. Have the class name some weeds, wildflowers, and cultivated plants they know. How are the weed, the wildflower and cultivated plant the same? They all have leaves, flowers, stems, and roots. Just as your body has a structure or pattern (legs, body, arms, head), the plant has a structure or pattern. The head of the flowering plant is the flower itself. It generally sits at the top or middle of the plant structure and plays an important part in the development of seeds. The flower is made up of four parts. In the center lie the stamens and the pistil. Stamens are long, thin pieces which surround the vase-shaped pistil. Protecting these parts are the petals, usually the bright colored part of the flower, and the sepals, the small, usually green leaf-like pieces under the flower. Holding each flower or group of flowers is a stem to which leaves are attached or meet at the base. Attached to the stem and extending into the ground are the roots. (See appendix.)

*Additional Activities*

☐ Make copies of the plant structure and have the students fill in the plant parts as you explain.
☐ Obtain some flowers from a florist or a funeral home and have the children take them apart and examine their parts.

*Materials*

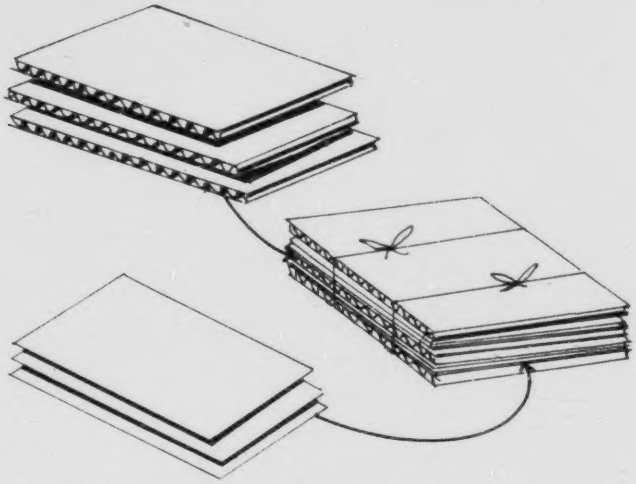
Overlay of flower parts (see appendix)
Student copy of flower part overlay
Flowers

### Environmental Experience 3: Conservation of Wild Plants and Preparation for Field Collection

*Conservation*

Sometimes wild plants seem to be everywhere, especially when they are in our garden or yard and we think of them as weeds. To conserve something in the past has often meant to save it, but today it generally means to use something wisely so that we can enjoy it and that there still will be enough of that object for people in the future to enjoy. Many wild plants that once were plentiful in North America are now so scarce that if they are picked unwisely there may not be any of them left. They will become extinct. Therefore, we must conserve these wildflowers and all others. Your state government recommends the wise use of wild plants and warns against the picking of plants close to extinction, such as the jack-in-the-pulpit, the large-flowered trillium, the pitcher-plant, the lady-slipper, and many others. Send for the state's guide to endangered wildflowers as a guide when observing wild plants. It recommends the enjoyment of these flowers through sight: *Let them live in your eye, not die in your hand!*

DO NOT
PICK
FLOWERS



Flower collections can be a wise use of wild plants when they are preserved well and used for study. Wise picking of wildflowers not on the endangered or rare list can add a lot to a class study of wildflowers. A good class collection is much better than a partial student collection. Often a general rule to even the picking of common wildflowers is a safe guide to follow: *Never pick more flowers than you will need, and never pick a flower unless there are at least five others in the general vicinity.*

*Identifying Wildflowers*
To collect wildflowers with the purpose of identification takes a bit of preparation. Have the children study or become familiar with the common identification guides. A flower growing in a field is much easier to identify than a pressed or dried one. Wildflower guides can be arranged many ways. In the bibliography are listed some of the more popular books in print. Have the children practice using one of these guides or any others that might be available. Start with a common flower that the children might already know before moving on to unusual flowers. While this may seem like a waste of time, it will save much confusion when you begin collecting.

*Making a Flower Press*
When collecting flowers for preservation, it is best to press the flowers in the field if at all possible. To do this, a flower press is needed. There are many types of commercial presses with a great range in price. If your school owns a press, borrow it and learn how it is used. If you don't have one, one can easily be made. Obtain from a local store or warehouse, boxes or pieces of corrugated cardboard. This will form the outside and divisions of your press. Cut the pieces all the same size. Fillers that will be placed between the cardboard are made from newspaper cut to the size of the cardboard. When the press is complete, it will look like a sandwich. To keep the pieces together, use rubber bands or string.

*Materials*
Plant identification books
Press: cardboard, newspaper, string or rubber bands, scissors

### Environmental Experience 4: Collecting, Pressing, and Drying Wild Plants

The class is now ready to go out and collect specimens of wild plants. Armed with flower guides, press, garden scissors, and index cards or a notebook, they are ready to begin. It is wise to carry along a small first aid kit or have one in a nearby place. Before setting out, decide what areas you hope to explore. Plant types vary with the terrain and surroundings: for example, marsh flowers, field flowers, and woodland flowers. When you come upon a flower you want to press, first try to identify the plant before picking. Fill out a card or notebook page explaining where the plant was found, what it is if you can tell at this time, the height of the plant before picking and any other details that will be needed later on. Carefully cut the plant at least six inches below the bloom so that some stem and leaves are included with the flower. If you leave the root, some plants may be able to grow again. If roots are desired for study, carefully dig or remove the whole plant. Carefully remove any soil clinging to the roots before pressing. Place the flower face down on the paper being careful to arrange the petals and leaves so they are as flat as you can get them. Close the press and retie the strings tightly. When returning to the classroom, weight the presses

down with any heavy object. Make sure the weight is equal on all parts of the press by placing a board on the press first. Plants should be dried quickly, not longer than a week after picking. To speed up drying, place presses near a radiator.

*Additional Activities*

- ☐ Take along art materials such as paper, crayons, paints, and colored pencils and draw and paint pictures of the plants in the field. A lap board made of corrugated cardboard makes a fine desk in the field.
- ☐ A new way to press plants that offers a better retention of flower color is to press flowers in the field between two pieces of clear contact paper. This forms a neat clean way to preserve plants and handle them for study. Warning: Sticky contact paper is sometimes difficult to handle; so carefully and slowly lay the flower on the paper and put the top piece on. Bubbles can often be smoothed out with pressure. Cut contact paper to size before removing from paper backing.

*Materials*

Flower presses
Scissors
Index cards or notebooks and pencils
Wild flower guides
First aid kit (recommended on any field trip)

### Environmental Experience 5: Mounting Your Collection

When the plants are dry but not crumbly, you are ready to mount them to be kept as your permanent collection. Two ways to mount the plants will be suggested. The first way is the traditional way and is fine but does not permit the children to handle the specimens as easily.

*Traditional Mounting Method*

Prepare your background paper on which the plants will be mounted. A good suggested size would be 11½ x 16½ inch sheets of stiff cardboard or paper. Arrange the plant on the paper making sure the leaves and petals are flat and that no leaves hang over the edge. The traditional arrangement is in an N shape. This is to insure that the whole plant can be mounted on one page. The plant can either be glued or taped to the background paper. Carefully lift each leaf and part, apply the glue and stick it to the paper. If tape is used, tape the plant across the stem and leaves securely. Important data such as the plant name (common and, if desired, Latin), plant characteristics, location and time of collection and other data should be included on the mount, either written on the background paper or on an index card attached to the background. If available, seeds of the plant can be kept in a small envelope attached to the background paper, too.

*"New" Mounting Method*

This method makes it possible for the children to handle the specimens without fear of crumbling them. The plant can be arranged on a background paper with the information card in one corner and the seeds in the other corner. Then cover the whole piece of cardboard with clear contact paper making a water-tight package of the plant and information. This can then be handled without fear of destroying the plant and dirty finger marks can be easily cleaned off.

*Materials*

Stiff paper or cardboard for backing
Glue or tape
Scissors
Index cards or paper
Clear contact paper
Pencil

### Environmental Experience 6: Uses of Wild Plants

*Medicines*

Wild plants are not only beautiful to look at but are valuable sources of food stuffs for animals and, in the past, man. Without many of the plants we think of as weeds or as having no value, the early pioneers would not have had many foods, dyes, and medicines. Many people today enjoy eating wild foods, even if they only eat walnuts or chew on sassafras. Think of all the different foods that you eat that come from wild plants or at one time were wild plants and have since been domesticated. Have the children write reports or paragraphs about the use of one of the wild plants they collected. Examples of the uses of some wild plants came from a booklet of kitchen remedies from the Blue Ridge and Great Smoky Mountains.

Oldtimey Highland Secrets:*

| *Remedy Used* | *For* |
|---|---|
| Ground ivy tea | Croup |
| Pennyroyal tea | Pneumonia |
| Boneset tea | Coughs |
| Sassafras tea | Bronchitis |
| Honey | Sore throats |
| Mint tea | Mouthwash |
| White walnut bark (boiled, crushed) | Apply to sore joints |
| Wet tobacco leaves (poultice) | Blisters, stings |
| Dandelion leaves (crushed, with water) | Wounds |
| Jewel weed | Poison ivy |
| Wild soapwort-Bouncing bet | Soap |

For fun, ask your parents and grandparents for any old remedies that your family might use. Make a bulletin board in your classroom showing the plant and telling what it was used for.

*Dyes*

Another important use of wild plants in the past was the dyeing of clothes. Many of the wildflowers you collected on your hike can be used to color cloth. Try dyeing some pieces of white cloth with different plants you collected. Here are some suggested plants to use and how to dye cloth.

*General Hints for Dyeing with Natural Colors from the Blue Ridge and Great Smoky Mountains*

Plant dyes work best on wool and silk. Cotton and linen dye with slightly more difficulty.

Cloth must be clean and free from any grease. Wet cloth before immersing in dye pot.

Any plant will color cloth but this color will wash out unless a mordant (chemical) binds this color in. Some mordants are alum, cream of tartar, copperas, potassium dichromate, sodium hydrosulphite and others.

Use soft water (rain water) for best coloring effect.

Keep cloth under dye water — without tangles.

Cooking time determines intensity of color. Cloth and dye should simmer gently for 30 minutes to 2 hours.

To prepare dye: Select twigs, bark, leaves or hulls of plants and boil hard to remove color. Strain and add water.

| *Some dye sources*† | *Add* | *Color* |
|---|---|---|
| Sassafras | Alum (2 Tbsp. to 1 lb. cloth) | Soft yellow tan |
| Black walnut hulls | None | Brown |
| Apple tree bark | Alum | Dark yellow tan |
| Hickory bark | Alum | Yellow |
| Arbor vitae | None | Rose: Red |
| Jewel weed | Few rusty nails | Yellow |
| Golden rod | Alum | Yellow |
| Poke berries | Vinegar | Red (fades) |
| Sumac berries | Copperas | Dark gray |
| Aster (white) | Alum | Soft gold |
| Dogwood | None | Red |
| Elderberry | Alum | Purple-blue |
| Queen Anne's lace | Alum | Bright yellow |
| Solomon's seal | None | Green |
| St. John's wort | None | Red |

*Foods*

Wild plants greatly supplemented the early pioneers' diet and made up most of the Indians' diet. You can enjoy many wild plants in your diet and probably already do without knowing it. Obtain a copy of *Stalking the Wild Asparagus* by Euell Gibbons and try a few!

*Additional Activities*

- ☐ Make a bulletin board showing the uses of wild plants. Display your dyed fabrics and pictures of its source. Research into how fabrics are dyed today.
- ☐ Collect some edible wild plants and have a wild food party for your class or another class in your school.
- ☐ Dye several yards of material and make some simple clothes out of them. Wear these clothes in a skit about the pioneers or Indians.

*Materials*

Books on wild plants, medicines, and foods
Cloth suitable for dying
Natural materials
A mordant
Pots
Long wooden spoons
A stove or hot plate

### Environmental Experience 7: A Dandelion Is Like a . .

O little soldier with the golden helmet,
  What are you guarding on my lawn?
You with your green gun
  And your yellow beard,
Why do you stand so stiff
  There is only the grass to fight.
Anonymous

What do the flowers look like to you? Are they dandelions, soldiers, or lions? Does the Jack-in-the-pulpit really look like a preacher in a pulpit? Choose a flower you like and write a story about it, giving him a personality and maybe a new name. Draw his picture or write a haiku poem about him.

### Environmental Experience 8: The Sound of Flowers

Choose a movie on wildflowers and prepare to show it to the children. While the movie is being shown, make sure no sound can be heard. After it is over, inform the students that they will see it again the next day. Have them bring in some of their records at this time and decide which music goes best with the film. After they have accomplished this experiment, they can be shown the movie with the regular sound track and decide which they like better.

### Environmental Experience 9: Ugly vs Beautiful

Have the children choose a weed they think is beautiful and one that is ugly. Let them discuss the reasons for the choices they have made in a large group session. Is everyone's final evaluation the same? Point to be made: What is beautiful to one may not be beautiful to another, and what is ugly to one may not be ugly to another.

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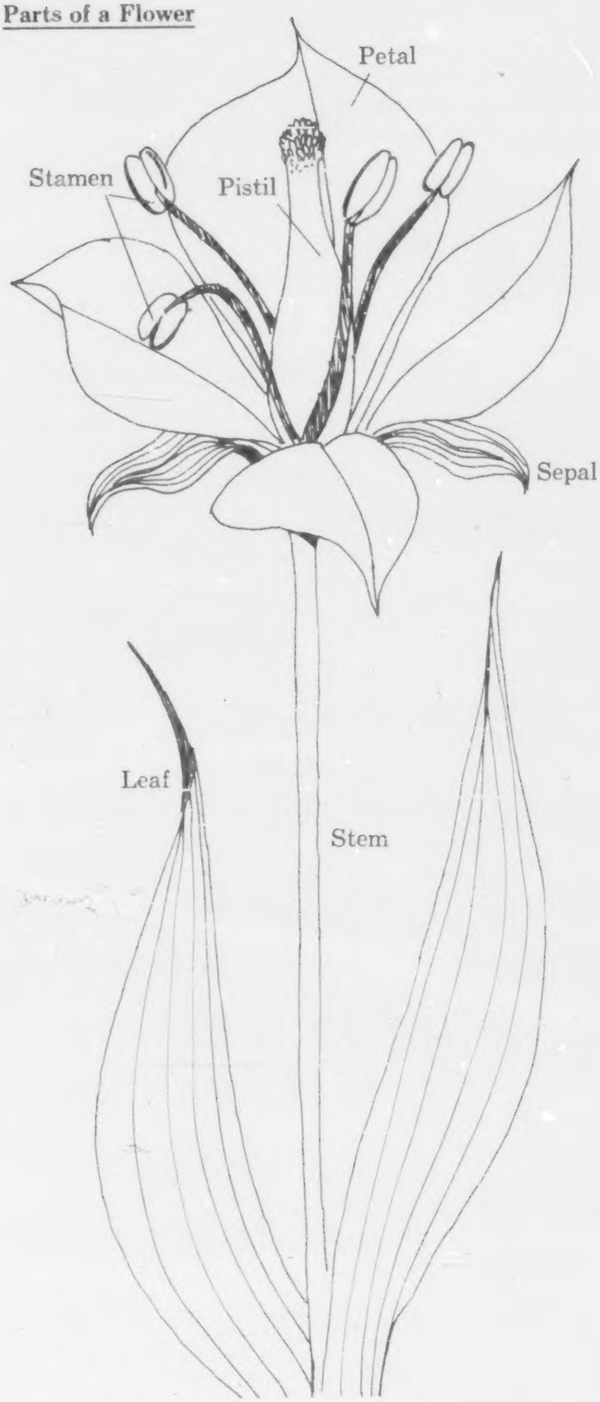
*(*Pioneer Comforts and Kitchen Remedies: Oldtimey Highland Secrets from the Blue Ridge and Smoky Mountains* by Ferne Shelton, Hutcraft, High Point, North Carolina, price, approx. $1.25)

†(*The Dye-Pot* by Mary Frances Davidson. Published by author, Route 1, Gatlinburg, Tenn. 37738, 1950, price $2.25 P.P. 6th Edition)

# Appendix

**Parts of a Flower**



## VOCABULARY LIST

weed
wildflower
cultivated
domestic
flower
stamens
pistils
petals
stems
leaves
sepals
roots
conservation
dye
mordant

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Wigginton, Eliot, ed. *The Foxfire Book.* Garden City: Doubleday & Co., Inc., 1972.

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### Films

*Wild Flowers of Field and Forest,* 11 min., Color, B/W, Coronet Films, 65 E. South Water St., Chicago, Illinois 60601.

### Filmstrips

*Wild Flowers Everyone Should Know,* Society for Visual Education, 1345 Diversey Parkway, Chicago, Illinois 60614.

### Pamphlets

*The Dye-Pot,* Davidson, Mary Frances, Rt. 1, Gatlinburg, Tenn. 37738.

*Ohio Wildflowers,* State of Ohio, Department of Natural Resources.

*Pioneer Comforts and Kitchen Remedies: Oldtimey Highland Secrets from The Blue Ridge and Great Smoky Mountains,* Shelton, Ferne, Hutcraft, High Point, North Carolina, 1965.

# The Endangered Predator and His Prey

The predator-prey relationship and the concept of populations are important factors in the maintenance of an ecosystem. These concepts are often hard to see in nature and almost as hard to see through activities. This unit attempts to get the child interested in predators and their prey and foster concern and interest for our endangered species. The teacher may wish to subscribe to one of the national associations concerned with the protection of endangered species before beginning this unit, so as to have background material on hand for discussion. A few of these associations are: Defenders of Wildlife, The National Audubon Society, and the National Wildlife Federation.

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## THE ENDANGERED PREDATOR AND HIS PREY

**Unit Objectives:**
The student will be able to

1. describe the effect of a population on a given environment.
2. discuss the detrimental conditions brought on as a result of crowding.
3. explain how the predator-prey relationship helps to alleviate crowding in a given environment.
4. identify small local predators in the school yard or neighborhood.

### Environmental Experience 1: Crowding

Our world is becoming more and more crowded every day. Everywhere you look there are people, people in the stores, people on the road, people in schools and people in the parks. How do more people affect your life style? Try this experiment.

Find a small room, like a cloak room or a storage area. One by one have your students go in the room until the room is stuffed with students. If possible pick a room where you can be packed in rather tightly. Stay in the room for five minutes or as long as you can stand it. When the class comes out have each child write down his feelings about the experience or record them on a tape recorder.

Now go to a large open room or field. Have the class spread themselves out throughout the field or room so that no two people are closer than five feet. Have the students write down or record their feelings about this experience.

Back in the classroom have the class members compare their notes. Which experience did they like better? Why? What didn't they like about the crowded experience? What did or didn't they like about the uncrowded experience? Which situation would they want to live in? Why? What problems might arise from living in a crowded situation?

*Additional Activities*

☐ Read about the rat experiments on crowding. John B. Calhoun "Population Density and Social Pathology." *Scientific American*, February 1962. (teacher reference)

☐ Study the living conditions and territory size of different animals.

### Environmental Experience 2: The Balance of Things

In the natural world crowding will often occur. Too many plants try to grow in one place, with the result that some plants will die or all plants will be underdeveloped and diseased.

Too many animals try to live in one area, the result being death by disease, or starvation as the amount of available food is used up. How can the natural world keep in balance so that the plants and animals both can live in a given area?

One such mechanism that helps keep a balance is the predator-prey relationship. As seen in other units, the food chain is a system in which eater becomes the eaten in the next level. Through this system all the parts of the chain are able as species to live, reproduce and survive.

A predator is an animal that kills and eats other animals to survive; man is a predator. Some other predators are owls, hawks, wolves, snakes, lynx, bobcats, cougars, foxes, spiders, praying mantises and robins. Some of these predators have received the reputation of evil, cruel killers. The continual killing of animals by predators is not cruel or wasteful; they kill for food alone and their role in the overall ecological picture is vital.

It has been shown that without predation, prey groups would become so large that they would soon be as crowded as the students in the storage room and use up all available food and soon begin to die of starvation. One example is the heavy increase of white-tailed deer in the eastern states. With the natural predator removed, their herds are steadily increasing, so that they overgraze the vegetation of an area and die from starvation in the winter.

Here are three suggestions to control these population explosions and the destruction of vegetation. a natural predator may be re-introduced; large numbers of the population may be permitted to starve in the hope that the vegetation will grow back; or hunting permits may be broadened. It has also been found that predators usually prey on the ill, young and old animals. Those animals that survive are the most fit (survival of the fittest).

With these considerations in mind view one of the films in the suggested readings and read about some of our natural predators, many of which are on the endangered wildlife lists. Consult some early records of your area as to the natural predators that once existed here and man's relationship to them.

*Additional Activities*

☐ Write reports on predators and their prey.

☐ Examine some of our legends and fairy tales which make the wolf the villain. Compare these stories with some studies on wolves.

☐ Play the game "Predator-Prey" by Urban Systems, Inc. It is an excellent way to understand the relationships of predator-prey and the control of population sizes.

### Environmental Experience 3: Predators and Prey in Our Area

What predators and prey live in your neighborhood? There probably are none of the larger predators such as wolves, bobcats or cougars, but there are certainly some of the smaller ones. Some biologists classify parasites as predators.

Observe as many predator-prey relations as you can. Draw pictures of the predators and their prey. Observe the robins on your school lawn and calculate how many worms are being caught. What other animals might eat worms? Dig up a square foot of lawn and count the number of worms you find. Then measure the lawn you wish to observe and calculate how many worms there are in your total lawn. How many predators were there? How long would it take before the worms would be all eaten? Each worm has eggs that will hatch in two to three weeks. Charles Darwin, in a study on earthworms, calculated that there are 5000 earthworms in one acre of soil.

Observe other small predators such as toads and frogs, praying mantises and spiders.

**Environmental Experience 4: What is to Happen to America's Large Predators?**

What is to happen to our large predators? When the pioneers first came to America, the woods were filled with bobcats, coyotes, bears, and birds of prey. Now, after years of killing and poisoning, not many of them remain. One of the main reasons they were destroyed was to protect the livestock of the farmer.

Consider some of the problems a farmer or cattleman or sheep raiser has to face. Consider the other side—the animal's: why does he kill? And consider the side of the ecologist: removing the predators may cause the prey to increase and multiply out of control.

Read about one of the endangered species and study one of the controversies. See the appendix.

# Appendix

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*Death of a Legend,* 50 min., Color, National Film Board of Canada, 680 - 5th Ave., New York, New York 10019.

*Eggs,* 10 min., Color, Radim Films, Inc., 17 W. 60th St., New York, N.Y. 10023.

*A Fable For Fleas,* 4 min., B/W, Creative Film Society, 7237 Canby Ave., Reseda, California 91335.

*Survival of the Kit Fox: A Conservation Case Study,* 13½ min., Color, Journal Films, 909 W. Diversey Parkway, Chicago, Illinois 60614.

*Wolves and Wolf Men,* 52 min., Color, Films, Inc., 1144 Wilmette Ave., Wilmette, Illinois 60091.

# The Cemetery

The cemetery offers a unique setting to study the past. Here in a small area is centered enough historical data to start a class on the study of the local community. Becoming aware of the past through the researching of lives of actual people makes historical facts more alive. It offers a beginning in the study of life cycles, human, plant and animal. The cemetery can be a start in the study of the local community as in the vacant lot and environmental quality index for school and neighborhood.

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## THE CEMETERY

**Unit Objectives:**
The student will be able to
1. identify his feelings toward the cemetery.
2. categorize and compile data from the cemetery in a meaningful form to supplement his study of history.
3. appreciate the past through direct experience in historical research.
4. describe some of the common patterns and symbols in tombstone designs.

### Environmental Experience 1: Cemetery Feelings

The cemetery is often pictured in movies and books as an evil place, reeking of ghosts and monsters. Because of these connotations, a fear and dread of cemeteries has arisen over the centuries, for instance, the graveyard scenes in Tom Sawyer. This attitude toward the cemetery is still being perpetuated today. While the adult knows this is mainly a device of the author to create fear and horror, the child does not. Much of this fear probably starts with the fear of the dark that every child at one time experiences. To overcome these fears, the child needs to clarify and examine his feelings and attitudes with experiences and facts. There are many ways in which this can be done. One such way is suggested below.

What is an attitude? Do you hate spinach or think rainy days are boring? Do you think school is terrible? They are all attitudes or feelings you have about something. Why do you hate spinach? Is it because you tasted it and really don't like it, or is it because everyone else seems to hate spinach, so you do too? Many times our attitudes and feelings come to us from books, friends, or movies we see. When you think of a cemetery, what kind of feelings and attitudes come to your mind? Make a list of all the different feelings and attitudes you have about a cemetery. How many of these have you actually experienced yourself and how many come from books and movies or friends? Which ones are true? That's hard! Discuss the ones you think are true. How do you know they are true?

J.R.STIT
1922 - 1969

Today many cities such as New York are opening their cemeteries for use as parks. How do you feel about that? Cemeteries are usually very beautiful places, with trees, flowers, ponds and interesting tombstones. If cemeteries are such awful places, why do we make them so beautiful looking? One of the biggest reasons is love, love for the persons that are buried there. Therefore, a cemetery is really a monument for the people we loved and that in itself is rather beautiful. Try making a list of words about the cemetery again, this time thinking about the cemetery as a place filled with love. How do your lists compare?

### Environmental Experience 2: Things You Can Learn from a Cemetery

The cemetery is a resource center stuffed full of information on many subjects: history, demography, geology, ecology. It also offers suggestions for many other studies.

Below are outlines of some of the many possibilities for study with reference to the use of the PACID concepts. Activities and suggestions for in-depth studies are also given.

*Additional Activities:*

☐ Make a census of the cemetery. Record all the names. Construct a family tree if the information is available. Practice constructing the family trees of your class.

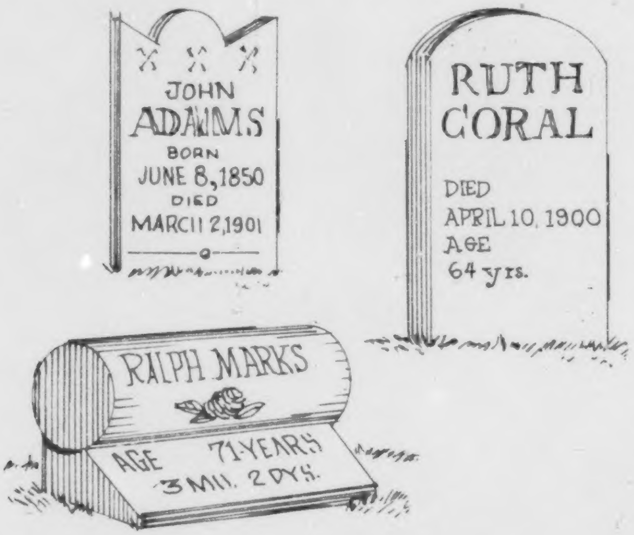
☐ Study the early pioneers in your area who may be buried in the cemetery. Sources of information include town histories, biographies, old maps, photographs, private letters, interviews with senior citizens, diaries, newspapers and public records.

☐ Map the distribution of graves in the cemetery. Is one section of the cemetery older? Is the cemetery arranged alphabetically? Are there family plots? Are any graves separated by chain or fences? Are these family plots? Sometimes people were buried together if they died from a certain epidemic.

*How Old?*

Usually you can tell the age of the people buried in the cemetery from the tombstones. Often the age will be written right on the stone. (e.g., 62 years, 3 months and

25 days). If not, the age can usually be worked out by subtracting the birth date from the death date. Here is a great math exercise. Dates and ages often appear in one of these three ways.



- ☐ Calculate the ages of all the people in the cemetery.
- ☐ Place the ages of the people on your distribution map. Is any pattern evident? Do you have a lot of deaths in any one year? Look in the local histories. Were there any epidemics or disasters that year?
- ☐ Who is the oldest in the cemetery? Who is the youngest? Are there more older than younger? Graph the number of people with the same year of death. Did more people die in the 1800 to 1850's, the 1850's to 1900's, the 1900's to the 1950's, or the 1950's to the 1970's?

*How Related?*

Often the headstone will tell how the people were related, for example, "the mother of," or "the wife." Try to trace families only from the stones. Watch out for name changes through marriage.

*Occupation*

Sometimes the occupation of the person can be told from his stone. Compile a list of all the occupations discovered from the stones. Supplement your list from the local histories and research. How have occupations changed from one century to the next?

- ☐ Study one period in your local area. Research local development and history. Create a period room or a play. Try some of the crafts of that period.

*Historical Events and Famous People*

Are there any famous people buried in the cemetery? What evidence of historical events can be seen in the cemetery?

- ☐ How many soldiers are buried in the cemetery? In which war did they fight?
- ☐ Research the lives of the famous people buried in the cemetery.

Here is an example:

Henry G. Hartsock
Born
Nov. 7th A. D. 1807
Died
Mar. 7th A. D. 1879
Age: 71 yrs. & 4 mos.
The Untiring Friend of the
Negro in the days of
American Slavery.

*Epitaphs*

Many of the older stones have "epitaphs," poems or facts about the person buried there.

- ☐ Collect the epitaphs from the cemetery. Is any one poem used more than once? What does the epitaph tell you about the person? What does it tell you about how others felt about that person?
- ☐ Cause of death can sometimes be learned from the epitaph. Can you tell this from any of the epitaphs in your cemetery?
- ☐ Write an epitaph for some famous Ohio person, such as Mad Anthony Wayne, Moses Cleaveland, or Johnny Appleseed.

*The Stone*

Tombstones are made from many different materials: granite, sandstone, slate, glass, wood and combinations of these. How many different types of tombstones are in the cemetery? Are there any unusual ones?

- ☐ Observe the weathering of the stones. Which stones seem to have weathered faster?
- ☐ Look for the stone carver's name. It is usually found in the lower right-hand corner at just about ground level.

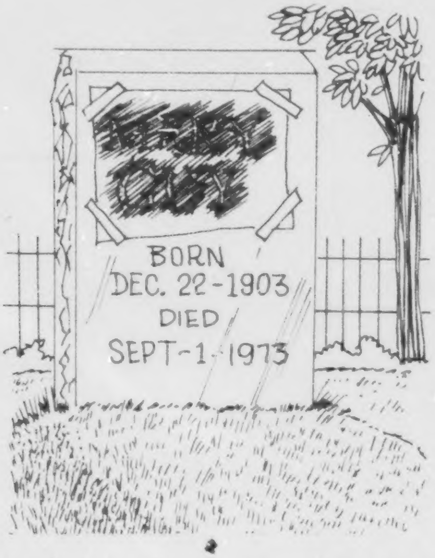
*Styles of Stones*

Tombstone styles are as many and as varied as the people who are buried there. The carving, shape, and style of the lettering offer a study in themselves. Many of the designs on tombstones are symbols and can be traced to Biblical or classical references. Changes in beliefs about death can be seen in the styles of the stones. James Deetz, an archaeologist, made a study of the changes in the 1600-1770 tombstones in New England, and found that as the Puritan attitudes declined, the style of the carvings moved from death heads (skulls) to angel heads.

- ☐ What are the different styles in the cemetery?
- ☐ Does any one style or design seem more prevalent?
- ☐ Read some books on symbols used on tombstones. See the appendix for a list of books.
- ☐ Learn about people who study tombstones and burials for a living, such as archaeologists, and paleontologists. Show a film about an archaeological dig. See the appendix for some suggestions.
- ☐ Discuss what the archaeologists of the future will discover when they excavate a graveyard or home of our times. What will have been preserved? How will they interpret what they find?

## Environmental Experience 3: The Trip to the Cemetery

In preparation for the trip to the cemetery, first get permission from cemetery officials for the visit. Discuss many of the aspects you hope to cover and things you hope to find. Since there is so much that can be done with the information from a cemetery, it might be suggested to divide the areas among the students; do only a few activities or restrict the trip to information gathering and rubbings. If possible, obtain a map of the cemetery from the custodian or church. Then you can study which areas you hope to visit. Since information retrieval is one of your major objectives, it might be helpful to design a form to be used by the students. Included is a sample form.



Tombstone rubbing is a good way to decipher some of the stones that are harder to read. Almost any lightweight paper can be used. Sometimes even tissue paper is used, but the best for strength and economy is newsprint. The end of a roll of blank newsprint can usually be obtained from your local newspaper printing office for free. Cut this paper into sheets about 18″ by 36″. A large box or bag will keep the paper neat during transport.

Instructions for rubbing:

*Step 1:* Pick out the stone you wish to rub. Remove any leaves or debris from the surface.

*Step 2:* Carefully tape the paper to the stone using masking tape. If possible extend the paper over the edges of the stone so that crayon marks do not get on the stone.

*Step 3:* Lightly rub the paper with a crayon or charcoal so that the letters will begin to raise. Dark colors make the best rubbings, but light colors are interesting for art displays. Continue rubbing *lightly* over the paper until the letters are clear being careful not to rip the paper. After the letters appear, stop rubbing so as not to color them in. Recessed letters rub much better than raised ones. Granite stones do not weather as quickly as sandstone, and therefore make better rubbings.

*Step 4:* Carefully remove the rubbing and pack for transport.

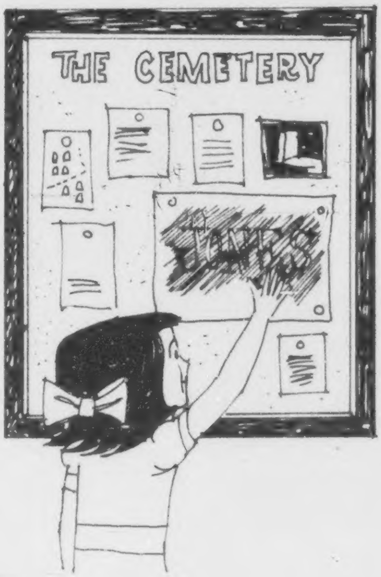
*Step 5:* To bring out the letters more when you have returned to the classroom, you can lightly outline the letters with a crayon or pencil. To fix the rubbing, spray it lightly with a charcoal fixer or hair spray.

Have cameras available for student use. Take pictures of stones you cannot rub. Pictures taken in early morning or late afternoon come out better because of the shadows.

*Materials:*
Blank newsprint
Crayons or charcoal
Masking tape
Pencils and recording sheets
Scissors
Large box or file for transport
Charcoal fixer or hair spráy

## Environmental Experience 4: When You Return

After the trip to the cemetery, compile your information, trying as many of the activities as you like. Make a display or bulletin board of your findings for other classes in the school. Write up a short local history of the data you have collected. Draw pictures of the cemetery and the designs on the tombs. Mount and display your rubbings. Visit other cemeteries and compare your findings, tracing designs and carvers, from one cemetery to the next. Have your class take a younger class to the cemetery or around the school yard and teach them how to make rubbings. Visit a local historical group and present your findings as a program.



## INFORMATION SHEET

| 1800 - 1899 (19th Century) | | | | 1900 - 1973 (20th Century) | | | |
|---|---|---|---|---|---|---|---|
| FULL NAME | BIRTH | DEATH | AGE | FULL NAME | BIRTH | DEATH | AGE |
| e.g., John Doe | 1834 | 1881 | 47 | e.g., Rich Smith | 1903 | 1965 | 62 |
| 1. | | | | 1. | | | |
| 2. | | | | 2. | | | |
| 3. | | | | 3. | | | |
| 4. | | | | 4. | | | |
| 5. | | | | 5. | | | |
| 6. | | | | 6. | | | |
| 7. | | | | 7. | | | |
| 8. | | | | 8. | | | |
| 9. | | | | 9. | | | |
| 10. | | | | 10. | | | |

Group the ages of the people whose names you recorded:

| | | | |
|---|---|---|---|
| 0-10 | | 51-60 | |
| 11-20 | | 61-70 | |
| 21-30 | | 71-80 | |
| 31-40 | | 81-90 | |
| 41-50 | | 91-100 | |

During what period did most people die? 19th Century? __________

20th Century? __________

What could be some possible reasons for this difference? __________

# Appendix

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*Archaeology — Pursuit of Man's Past,* 15 min., B/W, Stanton Films, 7934 Santa Monica Blvd., Los Angeles, California 90046.

*A Glimpse of the Past,* 10 Min., Color, Indiana University Audio Visual Center, Bloomington, Indiana 47401.

*Learning About the Past,* 10 min., Color, Indiana University Audio Visual Center, Bloomington, Indiana 47401.

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*Death's Heads, Cherubs and Willow Trees: Experimental Archaeology in Colonial Cemeteries,* Deetz, James and Dethlefsen, Edwin; *American Antiquity,* Vol. No. 4, 1966.

# An Environmental Quality Index

There has been much talk lately about the quality of life and what requirements are needed to have a life rated excellent. Many ecologists are warning now that if something is not done soon about pollution the quality of life in the future will be only poor or fair. To improve our life style so that it is excellent, one must begin with the identification of those elements that make up a quality life. These include not only a quality environment but an understanding of the values we place on human relations and interaction.

This unit attempts to introduce the idea of a quality environment while urging the student to investigate his own environment and the value it holds for him. This unit offers a good starting point in the study of specific environments, such as the vacant lot, the community, or the school.

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## AN ENVIRONMENTAL QUALITY INDEX FOR THE SCHOOL AND NEIGHBORHOOD

**Unit Objectives:**

The student will be able to:

1. explain his views about a quality environment.
2. conduct and use an environmental quality survey.
3. explain some of the elements that go into making a quality environment.
4. distinguish these elements through investigating various problems.

### Environmental Experience 1: What Is Environmental Quality?

We live in a world today that is beset by many problems. Not that there weren't problems in the past, but today there are even more. Our earth is dying, and fast! Air pollution, water pollution [illegible] waste, land destruction: all of these problems [illegible] and getting worse, not better. Even your students can remember when parking lots were fields and supermarkets were forests. Sad, isn't it? But that's progress! One sometimes wonders if progress isn't really steps backward instead of forward. The earth has serious problems. What can be done about them, if anything?

Everyone today wants the best that money can buy: color television, big cars, vacation homes, boats, trips, and the luxuries of life. But everyone also wants beautiful parks, clean rivers to boat on, sparkling seashores to swim in, and quiet, peaceful woods to walk in. Somewhere these two desires crash head-on. How can we have all the man-made luxuries and the natural luxuries, too?

What do you consider a quality or good environment to live in—clean air, clean water, pretty flowers, a park, the seashore nearby to swim in? What do you want in your quality environment?

Write a short essay on "What Is My Environment?" If you don't want to write an essay, write a poem or a play, or draw a picture of a quality environment. Then draw a picture or write about the environment where you live now and compare the two. Are they different, or can't you tell? Remember your environment is everything that surrounds you.

*Additional Activities*

- ☐ Put on your play about a quality environment for other classes.
- ☐ Design a perfect environment for yourself and for another person. Are they different? Why? Could you both live in the same environment?
- ☐ Interview other people about what they feel a quality environment is. Do their views differ from yours?

### Environmental Experience 2: An EQ Index

Now that you have discovered some of the aspects that you think make a quality environment, the time has come to see if they are present in your environment. To do this, you need a sort of test or examination of your environment.

Included in the appendix is an EQ Index. It is based on the average neighborhood and school, and uses the frequency of occurrence of detrimental elements as a scale for the quality of the environment. You can use this index with the whole class, or break up into committees, or you can design your own EQ Index.

To develop your own, begin by compiling a list of all the positive and negative elements in your neighborhood or school. Having the students make their own list is a good way to do this. After compiling your total list, have the students rate the elements either on a number scale or a scale of good, fair, and poor. Tally the results so that the average rating for each element is used. You are then ready to test out your index.

How does your environment rate? Do you have enough good elements or does your environment need work? The following seven concerns cân be used as a follow-up to a general EQ survey or as an in-depth part of the EQ index.

*Additional Activities*

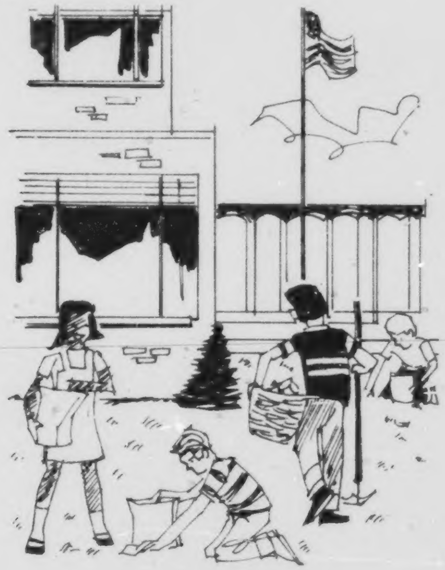
- ☐ Have others rate the elements in your survey.
- ☐ Survey the EQ index of your local neighborhood, or on the route you take to school.
- ☐ Present the results of your survey to other classes or to your principal or mayor.

*Materials*

An EQ index
Pencils
Clipboards

**Concern 1: Visual Blight**

Take a litter survey of the schoolgrounds. How much of what is present? Popsicle sticks? Gum wrappers? Kleenex? Collect the litter and display the amount that is left every day on the school grounds. Weigh it, or count the number of baskets collected, and graph the results.



Walk around the school grounds and look at the landscaping. Do you see any soil erosion taking place? Are there trees and shrubs to provide food and shelter for wildlife? Would this be possible? Talk with the custodian to determine what needs to be done to improve the grounds.

Interview the teachers and students about the litter problem. Ask if they would be willing to conduct an experiment. Encourage a "Don't Litter" campaign during recess, perhaps appointing guards. Each class could be in charge of keeping the grounds clean. Again, measure the amount of litter collected and compare the results of the experimental time with the first collection period. Graph to see if there has been a decrease; a hall bulletin board of a daily log could be kept.

Find out what plants and shrubs could benefit wildlife, and try to provide them. Are there any paper recycling centers in your area? Visit one or start one of your own.

**Concern 2: Pesticides and Fertilizers**

What quantity of pesticides and fertilizers are used around the school? Ask the custodian to give the names of those he uses. Check to see if any contain the most harmful chemicals. Ask him to list how helpful and necessary these fertilizers and pesticides are, and what he uses them for. Sources are listed in the appendix.

If harmful pesticides and fertilizers are being used, find alternatives. Ask a county cooperative extension agent. The price of the two different types of fertilizers is an important consideration. Talk to the principal, the custodian, and perhaps the business manager of the school system if you have found a practical alternative.

Do some research about pesticides, explaining the good and bad points about them. Display the findings on a bulletin board or chart.

Explore the drainage system of the school to note where the runoff water containing the fertilizer and pesticides goes.

**Concern 3: Solid Wastes**

Investigate whether the soda machine has returnable bottles; if the cafeteria tries to reuse the mayonnaise and mustard jars in some way, e.g., aquariums and terrariums for the classes.

Monitor the lunchroom and determine the number or weight of one day's milk cartons. Counting the thrown-away cartons, weigh about ten to estimate the total weight of the day's refuse in milk cartons. What conclusions can you draw?

If returnable bottles are not being used, try to convince the principal to order them. Check costs!

Interview students to see if they would want milk glasses so that the cartons would not have to be used. Ask specific questions: how many times a week would you give up recess to wash the glasses? Would you be willing to bring a glass from home, so that the school would not have to buy any? Would you be in charge of your own glass?

What about your home? Do you use returnable bottles? Do you recycle cans and bottles or re-use them? Survey the amount of solid waste your house creates in one week. See Appendix for some things you can do to have a quality home environment.

**Concern 4: Wasted Paper**

How much paper is wasted? Inventory the wastebaskets for paper to determine how much paper has been used. Ask the custodian to empty the baskets after the last period of the day. The students can look at the paper to see how many pieces have writing on both sides, separating it into two piles. Each pile should be weighed or measured in some way. Add both piles (one of paper used on both sides, one of paper used only on one side) to obtain the total consumption of paper, and determine what percent of it could be re-used. This can be done for one classroom, two, or the entire school.

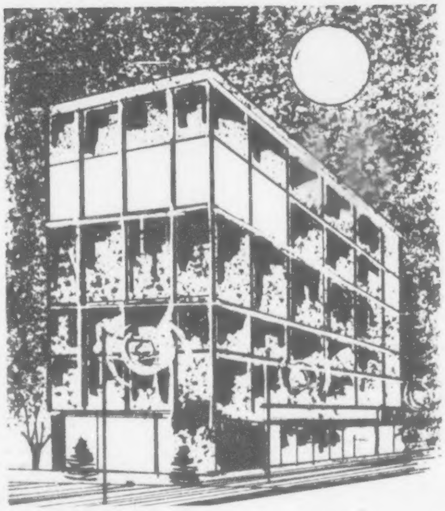
Interview students and teachers to see if they will cooperate in using less paper, or utilizing it more completely. Display posters of used paper to encourage this practice. After running the experiment for one week, compare the total consumption of paper, and the use of it. Is less paper being wasted? Chart the results. In the interview, ask if students and teachers would mind writing on used paper; ask the teacher if she/he would accept homework or class assignments on the back of old assignments.

Write to paper companies for information on types of paper and how paper is made.

**Concern 5: Electricity**

How many lights are left on all day or night in your school? Have the students make a list of the lights in the building: hall lights, classrooms, bathrooms, gym, office, boiler room. Make a chart for each of the lights, with the days of the week on one edge and the hours of the day on the other. Check hourly which lights are on, asking the custodian to mark the one left on all night or after hours.

Write on the sheet if the light was necessary; if there was adequate light from the sun without electricity

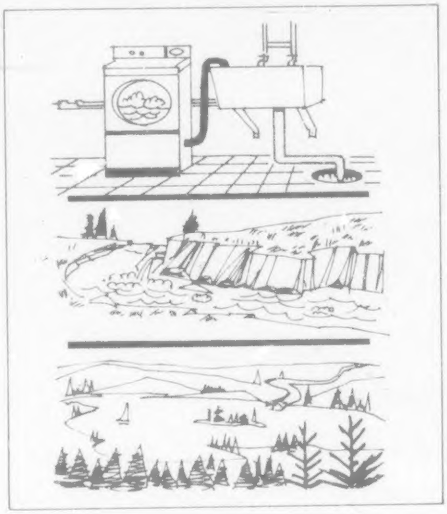


(check to see if the shades were up or down); if the room was in use. Determine how efficient the lighting of the school is.

Again, interview students and teachers to see if they would be willing to work with less light on sunny days. Run an experiment for another week and again check the consumption with a chart, noting any differences. Wait two or three weeks and run it again to see if there really has been a lasting change. If not, re-interview teachers and students for their comments.

**Concern 6: Phosphates and Harmful Detergents**

What soaps are used throughout the school and home? Ask the cafeteria workers and the custodian to list those products used. Find out if there are less harmful detergents available at a comparable cost. Ask the principal or custodian why the specific soaps now used are bought. Distribute a list of those detergents not harmful to the environment. Research to discover why certain soaps are more harmful than others, and what their effects are. Be cautioned that some no-phosphate detergents contain chemicals that are also highly detrimental to life. Check appendix for list of common detergents and their phosphate levels.

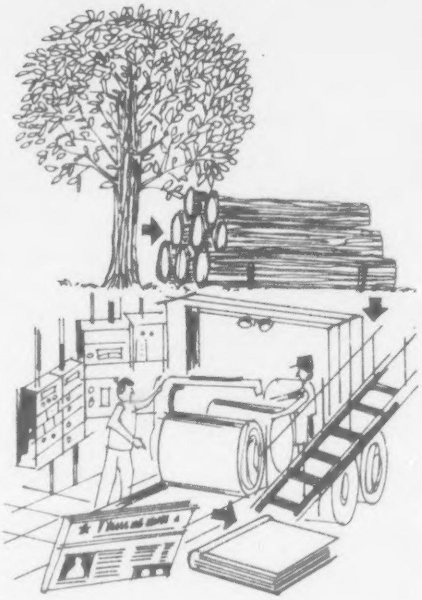


**Concern 7: Recycled Paper**

Does the school use recycled paper? Ask the principal what paper is used, and where it is obtained. Determine the price of it. Contact forestry personnel or a lumber company representative to determine how many pounds of paper a tree makes. (Approximately 113 pounds.) Ask about the waste in the process. Contact a company producing recycled paper, and discuss the cost of it and the different types produced.

Discuss the terms "recycled paper" and "recycled fibers." (Recycled fiber uses the waste that the paper company itself produces with low grade fibers; recycled paper uses paper returned to the factory, including newspaper, paper cups, and magazines.) Explore how this problem correlates with solid waste.

Interview the students to determine what they would give up to save money so that the school could use recycled paper. Using both sides? Fewer crayons? Fundraising? Fewer books? Ask the principal what would be feasible.



# Appendix

**Dangerous Pesticides**

Avoid these pesticides for home or backyard use. They may be on the market as dusts, sprays, granules, pellets and baits or formulated into products like floor wax, room deodorizers and paint. Read all labels carefully. Advice differs on pesticides. Many experts would add to this listing, but there seems to be fairly general agreement on these.

*Insecticides*
Aldrin
Benzene hexachloride
Chlordane
DDD (TDE)
DDT
Dieldrin
Endosulfan
Endrin
Heptachlor
Lindane
Perthane
Telodrin
Toxaphene

*Rodenticides*
ANTU
Sodium fluoro-acetate (1080)
Thallium

*Herbicides*
2,4-D
2,4,5-T

*Fungicides*
Captan
Dintro compounds
Folpet

Do not use any pesticide containing mercury, lead or arsenic.

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**List of Detergents and Their Phosphate Levels**
*Guidelines for Citizen Action on Environmental Problems**

| Detergents | Amt Per Washload | Phosphate Units Per Washload |
|---|---|---|
| Add-It | ½ c. | 0 |
| C. Water All (liq) | ½ c. | 0 |
| Modway | ½ c. | 0 |
| Neo-Kleen Plus | ¼ c. | 0 |
| Nu-Wash | 2 T. | 0 |
| Purewater | ½ c. | 0 |
| Trend | 1½ c. | 6 |
| Special-T | ½ c. | 7 |
| Instant Fels | 1½ c. | 8 |
| Tetra D | ¼ c. | 9 |
| Twin Oaks | ¼ c. | 12 |
| Basic L | ¼ c. | 14 |
| Nutriclean CLC | 2 oz. | 14 |
| Wisk | ½ c. | 15 |
| Amway SA-8 + | ¼ c. | 17 |
| Blue Magic | 1¼ c. | 19 |
| Bestline B-7 | ¼ c. | 20 |
| Nutrilite Conc | ¼ c. | 20 |
| Breeze | 2 c. | 36 |
| Field 222 | ¾ c. | 37 |
| Conc. All | 1 c. | 38 |
| Sears | ½ c. | 38 |
| Ad | 1 c. | 38 |
| Easy Life Enzyme | 1½ c. | 38 |
| Duz | 1½ c. | 39 |
| Easy Life Blue | 1½ c. | 39 |
| Tide XK | 1¼ c. | 40 |
| American Family | 1¼ c. | 40 |
| Fluffy All | 1½ c. | 42 |
| Burst | 1 c. | 42 |
| HLD | ½ c. | 44 |
| Vim | 4 tabs. | 44 |
| Bonus | 2 c. | 47 |
| Salvo | 2 tabs. | 51 |
| Dash | 1 c. | 60 |
| Fabric Softeners | | |
| Generally have no phosphates | | |
| Enzyme Presoaks | | |
| Trizyme | ¼ c. | 15 |
| Axion | ½ c. | 27 |
| Brion | ½ c. | 30 |
| Biz | ½ c. | 35 |
| Sears | ½ c. | 55 |
| Additives | | |
| Fels Naphtha Bar | any | 0 |
| Borateem | any | 0 |
| Borax | any | 0 |
| Washing Soda | any | 0 |
| Calgon | ½ c. | 57 |
| Rain Crystals | 1 pkt. | 66 |
| Starches | generally none | |
| Bleaches and Bluing | | |
| Liquid Chlorine | generally none | |
| LaFrance Bluing | ½ c. | 0 |
| Miracle White | ½ c. | 0 |
| LaFrance Enzyme | ½ c. | 2 |
| Action | 1 pkt. | 5 |
| Mont. Wards | ⅔ c. | 21 |
| Launder Maid | 1 c. | 25 |
| Cheer | 1¼ c. | 27 |
| Dreft | 1¼ c. | 27 |
| Silver Dust | 2 c. | 28 |
| Surf | 1¼ c. | 28 |
| Woolite | ½ c. | 28 |
| Bold | 1¼ c. | 29 |
| Cold Power | 1¼ c. | 29 |
| Gain | 1¼ c. | 29 |
| Rinso | 1¼ c. | 29 |
| Easy Life (HD) | 1½ c. | 32 |
| Drive | 1¼ c. | 33 |
| Fab | 1½ c. | 34 |
| Oxydol Plus | 1¼ c. | 34 |
| Cold Water All | 1¼ c. | 35 |
| Punch | 1¼ c. | 35 |
| Ajax | 1¼ c. | 36 |
| Amway Dry Blch. | 2 T. | 6 |
| Snowy | ¾ c. | 10 |
| Beads O'Bleach | 2 oz. | 16 |
| Stardust | 1 c. | 41 |
| Boosters | | |
| Smashing White | ¼ c. | 12 |
| Laundry White | ¼ c. | 13 |
| Climalene | ¼ c. | 14 |
| Easy White | ½ c. | 24 |
| Anything Goes | ½ c. | 27 |
| Miracle White | ½ c. | 41 |
| Cleansers | | |
| Babbitt's | can (14 oz) | 3 |
| Bon Ami | can | 5 |
| Hep | can | 6 |
| Ajax | can | 10 |
| Air Maid | can | 12 |
| Kitchen Klenzer | can | 17 |
| Comet | can | 30 |
| Dishwashing Liquids | | |
| Generally have no phosphates | | |
| Bath Aids | | |
| Shampoos | generally none | |
| Bar soaps | generally none | |
| Calgon Oil Beads | 3 T. | 13 |
| Calgon Bouquet | 3 T. | 15 |
| Automatic Dishwashing Compounds | | |
| Basic D | 1 t. | 1 |
| Special-T | 1 T. | 1 |
| Amway | 1 T. | 5 |
| Calgonite | 2 T. | 6 |
| Advance | 2 T. | 6 |
| Finish | 1½ T. | 6 |
| Electra Sol | 2 T. | 6 |
| Dishwasher All | 2 T. | 9 |
| Cascade | 2½ T. | 11 |
| Jet Dry Liquid | bottle | 21 |
| Jet Dry Solid | cake | 21 |

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**Guidelines for Citizen Action on Environmental Prob-*

*lems* is available at bulk rates: 100 or more copies, 10¢ each; 1000 or more copies 8¢ each. Enact Ecology Center, 417 Detroit Street, Ann Arbor, Michigan 48104

**How to Have a Quality Home Environment**

1. Do not use colored paper, napkins, toilet paper or tissue. The dyes used are not biodegradable.
2. Use only those lights needed; do not leave lights on all night. Use sunlight whenever you can.
3. Don't use electric blankets or air conditioners — they are heavy users of electricity.
4. Use non-leaded gas.
5. Don't be a litter bug; use a litter bag in your car and home.
6. Use soap and detergents that are low in phosphates and other chemicals.
7. Use paper up completely — write all over it.
8. Buy food in bulk — saves money and paper.
9. Buy milk in returnable bottles.
10. Sort metals, paper and glass so that they can be recycled.
11. Take all your recyclables to a recycling center.
12. Don't use weed killers.
13. Give your old clothes to friends or rummage sales or use them till they are worn out — use them as rags and cleaning cloths.
14. Plant a tree or flowers.
15. Play your radio, TV and record players softer — SHHHHHHH!
16. Re-use paper bags and containers.
17. Have a neat, clean home and yard — saves on repairs too!
18. Buy a real Christmas tree this year and plant it in your yard later.
19. Be kind and helpful — this make a quality environment too!
20. Above all — Try to do your best and keep looking out for new ways to make your environment a quality environment.

**EQ Index Scoring System:**

The values have been arbitrarily assigned; if your values differ, the scoring system can be changed. The total of points for each category is as follows:

Miscellaneous total possible

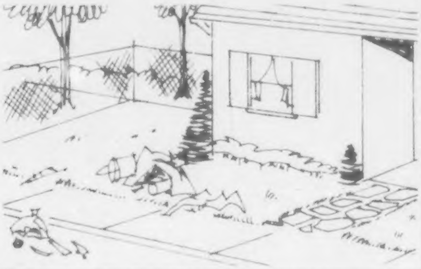
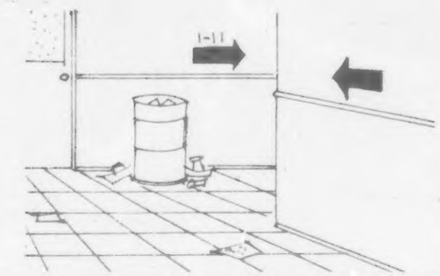
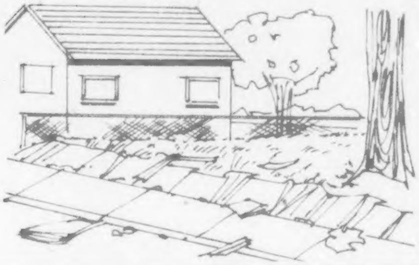
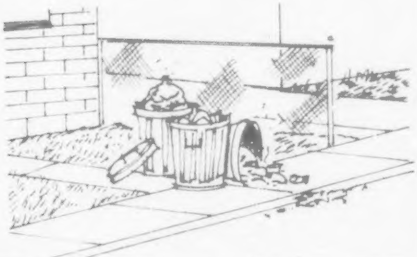
| | Perfect | Excellent | Good | Fair | Poor |
|---|---|---|---|---|---|
| 1. Litter | 0 | 10 | 20 | 100 | 200 |
| 2. Garbage and trash | 0 | 10 | 145 | 270 | 600 |
| 3. Defacement | 0 | 0 | 170 | 295 | 450 |
| 4. Upkeep | 0 | 0 | 135 | 255 | 600 |
| 5. Streets | 0 | 5 | 70 | 150 | 200 |
| TOTAL | 0 | 25 | 540 | 1070 | 2050 |
| Miscellaneous—total possible points—2200 + | 0 | 600 | 1200 | 1800 | 2200 |
| All to Poor—2200 | | | | | |
| ¾ to Fair—1800 | 0 | 625 | 1740 | 2870 | 4250 |

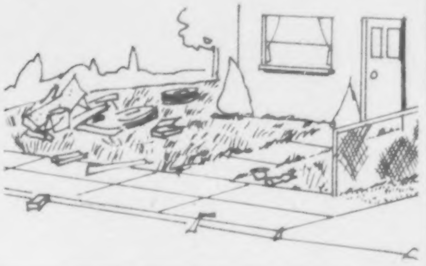
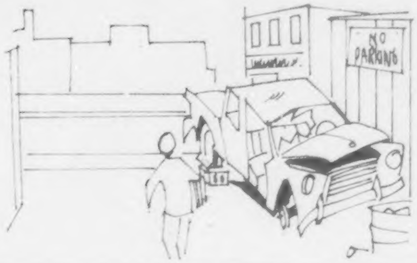
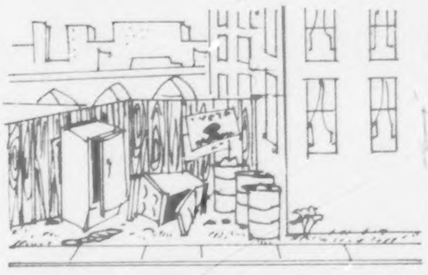
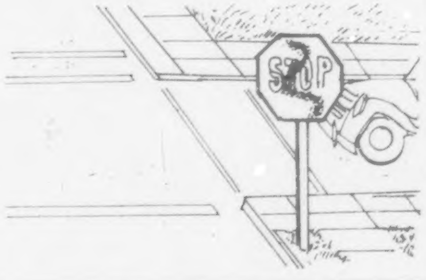
½ to Good—1200
¼ to Excellent—600
None to Perfect—0

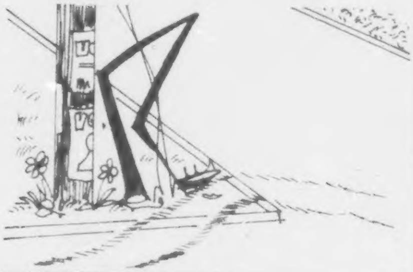
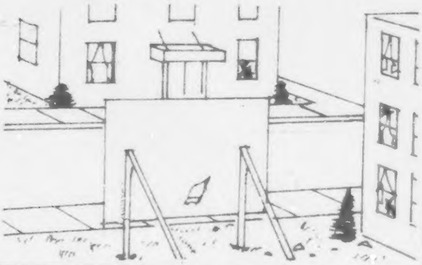
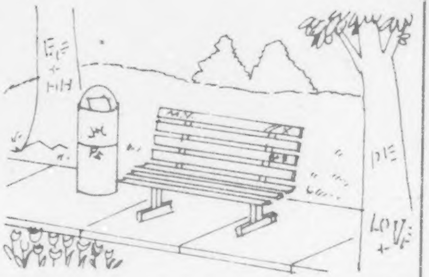
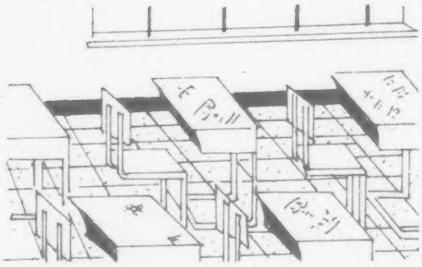
| | | |
|---|---|---|
| EQ RATING | Perfect | 0 |
| | Excellent | 0-625 |
| | Good | 625-1740 |
| | Fair | 1740-2870 |
| | Poor | 2870-4250 |

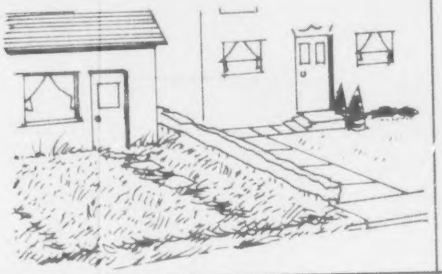
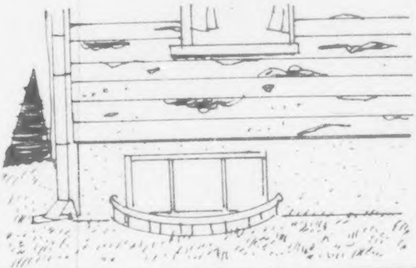
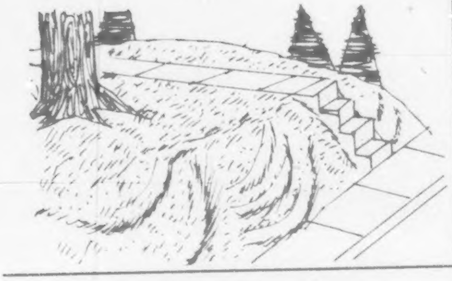
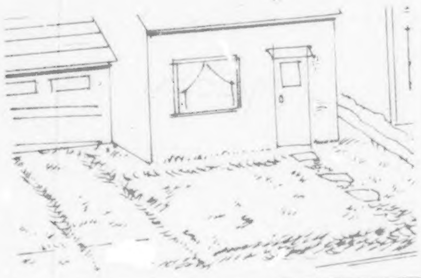
Note: If you want to change any of the categories or ratings, they must be adjusted in the total figures so that the rating will work.

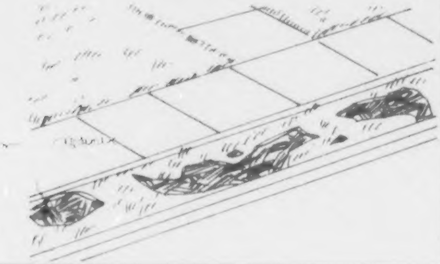
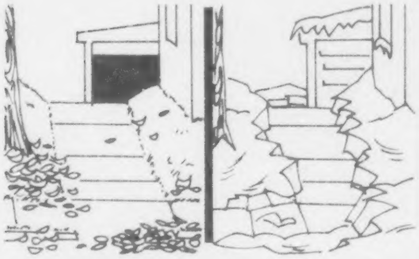
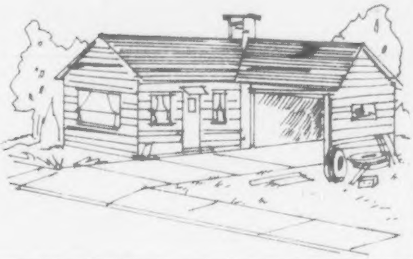
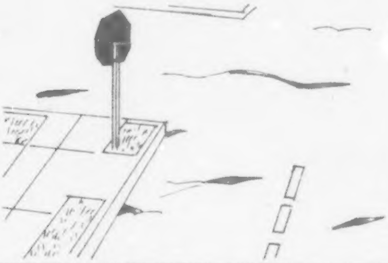
## An EQ Index for Your School and Neighborhood

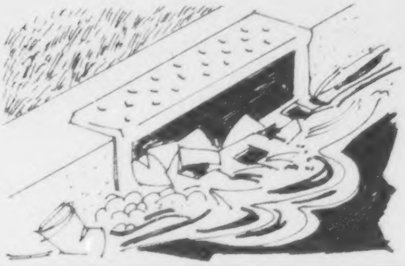
| | Counting Space | Number | Points |
|---|---|---|---|
| I. LITTER (paper, metal, glass)<br>A. On grass or streets<br> | Number of pieces per block | | |
| B. In hallways<br> | Number of pieces per hall | | |
| II. GARBAGE AND TRASH<br>(organic refuse and piles of trash)<br>A. Garbage and trash on streets and lawns<br> | Amount per block<br>None<br>Some<br>A lot | | |
| B. Garbage cans without lids or spilling over<br> | Number per block | | |

|  | Counting Space | Number | Points |
|---|---|---|---|
| II. CONT'D.<br>C. Construction debris (bricks, wood, cement, paper)<br> | Amount per site<br>None<br>Some<br>A lot |  |  |
| D. Abandoned cars left in streets and yards<br> | Number per block |  |  |
| E. Abandoned refrigerators, stoves, washers, dryers<br> | Number per block |  |  |
| III. DEFACEMENT<br>A. Road signs spray-painted or destroyed<br> | Number per block |  |  |

|  | Counting Space | Number | Points |
|---|---|---|---|
| III. CONT'D.<br>B. Defaced utility poles (bent, posters, or painted)<br> | Number defaced poles per block |  |  |
| C. Broken windows<br> | Number per block |  |  |
| D. Initials on trees<br> | Number initialed trees per block |  |  |
| E. Desks<br> | Number initialed desks per room |  |  |

|  | Counting Space | Number | Points |
|---|---|---|---|
| IV. UPKEEP<br>A. Unmowed lawns<br> | Number per block |  |  |
| B. Chipped and cracked paint on walls and houses<br> | Number walls per block |  |  |
| C. Soil Erosion<br> | Amount per block<br>None<br>Some<br>A lot |  |  |
| D. No curbs or sidewalks<br> | Amount per block<br>None<br>Some<br>A lot |  |  |

| | Counting Space | Number | Points |
|---|---|---|---|
| IV. CONT'D.<br>E. Unplanted tree lawn (area between street and sidewalk)<br> | Amount per block<br>None<br>Some<br>All | | |
| F. No snow or leaf removal<br> | Amount per block<br>All<br>Some<br>None | | |
| G. Building needing carpentry repair<br> | Number buildings needing work per block | | |
| V. STREETS<br>A. Pot holes and large cracks<br> | Number per block | | |

| | Counting Space | Number | Points |
|---|---|---|---|
| V. CONT'D.<br>B. Clogged sewers<br> | | | |

VI. MISCELLANEOUS (add 100 points each)

1. Standing water—no sewers ______
2. Air pollution ______
3. Dogs unleashed ______
4. No public transportation ______
5. Open dumps ______
6. Noisy highways or factories ______
7. Bad smells ______
8. Housing problems ______
9. Animal excretion ______
10. No pictures on school walls ______
11. Poor lighting ______
12. Crowded rooms ______
13. Noisy classrooms or halls ______
14. No policemen ______
15. No library ______
16. No movies ______
17. No recess ______
18. No air conditioning in school ______
19. No carpeting in school ______
20. No flowers ______
21. No swimming pools ______
22. No playgrounds ______

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BONUSES (Subtract 100 points for each)

1. A community planning organization ______
2. Friendly neighbors ______
3. A "neat" place to play outdoors ______
4. A concerned mayor ______
5. An anti-pollution group ______
6. Playground with equipment ______
7. A historical marker or monument ______
8. Others ______

**Scoring Breakdown:**

**EQ Index for School and Neighborhood**

| | Point System | | | | |
|---|---|---|---|---|---|
| Category and qualification | Perfect | Excellent | Good | Fair | Poor |
| I. Litter (paper, glass, metal on grass, streets, or hallways) | | | | | |
| A. Grass and streets: | | | | | |
| 1) None | 0 | | | | |
| 2) 1-10 pieces per block | | 5 | | | |
| 3) 10-20 pieces per block | | | 10 | | |
| 4) 20-5 pieces per block | | | | 50 | |
| 5) 50 pieces per block | | | | | 100 |
| B. School | | | | | |
| 1) None | 0 | | | | |
| 2) 1-5 pieces per hallway | | 5 | | | |
| 3) 5-10 pieces per hallway | | | 10 | | |
| 4) 10-20 pieces per hallway | | | | 50 | |
| 5) 20+ pieces per hallway | | | | | 100 |
| TOTALS | 0 | 10 | 20 | 100 | 200 |
| II. Garbage and Trash (organic refuse and piles of trash) | | | | | |
| A. On lawns and streets (organic-food, grass cuttings) | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) Some per block | | | 10 | 10 | |
| 3) A lot per block | | | | | 50 |
| B. Garbage cans without lids or spilling over | | | | | |
| 1) None per block | 0 | | | | |
| 2) 1-5 per block | | 10 | | | |
| 3) 5-10 per block | | | 25 | | |
| 4) 10-20 per block | | | | 50 | |
| 5) 20+ per block | | | | | 100 |
| C. Construction debris left on site | | | | | |
| 1) None | 0 | 0 | | | |
| 2) Some | | | 10 | 10 | |
| 3) A lot | | | | | 50 |
| D. Abandoned cars left in streets and yards | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) 0-5 per block | | | 50 | | |
| 3) 5-10 per block | | | | 100 | |
| 4) 10+ per block | | | | | 200 |
| E. Abandoned refrigerators, stoves, washers, dryers | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) 1-5 per block | | | 50 | | |
| 3) 5-10 per block | | | | 100 | |
| 4) 10+ per block | | | | | 200 |
| With doors an extra 100 | | | | | |
| TOTALS | 0 | 10 | 145 | 270 | 600 |
| III. Defacement | | | | | |
| A. Road signs spray painted or destroyed | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) 1-5 per block | | | 50 | | |
| 3) 5-10 per block | | | | 75 | |
| 4) 10+ per block | | | | | 100 |
| B. Defaced utility poles (bent, posters, painted) | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) 1-5 per block | | | 50 | | |
| 3) 5-10 per block | | | | 75 | |
| 4) 10+ per block | | | | | 100 |

| | | | Point System | | |
|---|---|---|---|---|---|
| | Perfect | Excellent | Good | Fair | Poor |
| C. Broken windows | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) 1-5 per block | | | 50 | | |
| 3) 5-10 per block | | | | 75 | |
| 4) 10+ per block | | | | | 100 |
| D. Initials on desks and trees | | | | | |
| Trees: | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) 1-3 trees per block | | | 10 | | |
| 3) 3-5 trees per block | | | | 50 | |
| 4) 5+ per block | | | | | 100 |
| Desks: | | | | | |
| 1) None per room | 0 | 0 | | | |
| 2) 1-5 desks per room | | | 10 | | |
| 3) 5-10 desks per room | | | | 20 | |
| 4) 10+ desks per room | | | | | 50 |
| TOTALS | 0 | 0 | 170 | 295 | 450 |
| IV. Upkeep | | | | | |
| A. Unmowed lawns | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) 1-5 per block | | | 50 | | |
| 3) 5-10 per block | | | | 100 | |
| 4) 10+ per block | | | | | 200 |
| B. Chipped and cracked paint on walls and houses | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) 1-10 per block | | | 5 | | |
| 3) 10-50 per block | | | | 50 | |
| 4) 50+ per block | | | | | 100 |
| C. Soil erosion | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) Some per block | | | 10 | 10 | |
| 3) A lot | | | | | 50 |
| D. No curbs or sidewalks per block | | | | | |
| 1) All per block | 0 | 0 | | | |
| 2) Some per block | | | 10 | 10 | |
| 3) None per block | | | | | 50 |
| E. Unplanted tree lawn (area between street and sidewalk) | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) Some per block | | | 10 | 10 | |
| 3) All per block | | | | | 50 |
| F. No snow or leaf removal | | | | | |
| 1) All per block | 0 | 0 | | | |
| 2) Some per block | | | 25 | 25 | |
| 3) None per block | | | | | 50 |
| G. Buildings needing carpentry repair | | | | | |
| 1) None per block | 0 | 0 | | | |
| 2) 1-10 per block | | | 25 | | |
| 3) 10-20 per block | | | | 50 | |
| b) 20+ per block | | | | | 100 |
| TOTALS | 0 | 0 | 135 | 255 | 600 |

|  |  | Point System |  |  |  |
|---|---|---|---|---|---|
|  | Perfect | Excellent | Good | Fair | Poor |
| V. Streets |  |  |  |  |  |
| A. Pot holes and large cracks |  |  |  |  |  |
| 1) None per block | 0 |  |  |  |  |
| 2) 1-10 per block |  | 5 |  |  |  |
| 3) 10-20 per block |  |  | 20 |  |  |
| 4) 20-50 per block |  |  |  | 50 |  |
| 5) 50+ per block |  |  |  |  | 100 |
| B. Clogged sewers |  |  |  |  |  |
| 1) None per block | 0 | 0 |  |  |  |
| 2) 1-5 per block |  |  | 50 |  |  |
| 3) 5+ per block |  |  |  | 100 | 100 |
| TOTALS | 0 | 5 | 70 | 150 | 200 |
| GRAND TOTALS |  |  |  |  |  |
| 1. Litter | 0 | 10 | 20 | 100 | 200 |
| 2. Garbage and Trash | 0 | 10 | 145 | 270 | 600 |
| 3. Defacement | 0 | 0 | 170 | 295 | 450 |
| 4. Upkeep | 0 | 0 | 135 | 255 | 600 |
| 5. Streets | 0 | 5 | 70 | 150 | 200 |
|  | 0 | 25 | 540 | 1070 | 2050 |
| Plus totals possible from miscellaneous | 0 | 600 | 1200 | 1800 | 2200 |
|  | 0 | 625 | 1740 | 2870 | 4250 |

## VOCABULARY LIST

environmental quality index
pesticide
phosphate
consumption
recycling
visual blight
fertilization
solid waste
recycled paper
recycled fiber

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*A Fable for Fleas,* 4 min., B/W, Creative Films Society, 7237 Canby Ave., Rodeda, California 91335.

*For Your Pleasure,* 4 min., Color, Mass Media Association, 2116 N. Charles St., Baltimore, Maryland 21218.

*Island of Dreams,* 10 min., Color, Texture Films, Inc., 1600 Broadway, New York, New York 10011.

*Pollution,* 56 min., Color, Environmental Education, Inc., 732 7th St. N.W., Washington, D.C. 20006.

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# Poetry in the Environment

Why poetry in an environmental curriculum? Charles Pierce, an American philosopher, felt that there were four ways of knowing truth. The first he called the method of tenacity. Here men hold firmly to the truth, the truth that they know to be true only because they hold firmly to it. The second method is the method of authority. The fact that the belief is supported by tradition or great men tends to prove its validity. The third method is the *a priori* method. In this method, man trusts that his inborn reason naturally leads him to truth. And the last method is the method of science.

Today, we often rely too heavily on the last method for everything — but what about inborn reasoning or personal feeling; how do they fit in this world of hard, cold facts? Of what value is the natural environment? True, it sustains our physical life, but what of the feeling of inner peace? The releasing atmosphere? The aesthetic beauty? And the feeling of escape, adventure and fun? Aren't these part of the natural world too? Poetry offers man a way to experience the natural world through feelings and awareness.

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# POETRY IN THE ENVIRONMENT

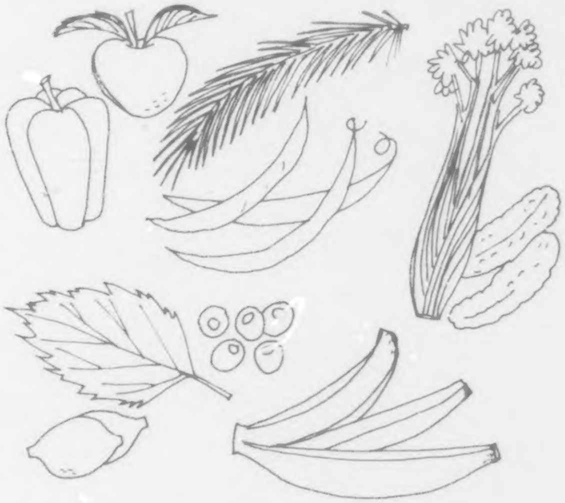
**Unit Objectives:**
The student will be able to
1. distinguish number of beats or rhythmic patterns in lines.
2. know the structure and purpose of haiku.
3. know the structure and purpose of cinquain.
4. write haiku poems. (See teacher background.)
5. write cinquain poems. (See teacher background.)
6. express feelings, ideas and opinions resulting from a direct experience.

**Environmental Experience 1: Poetry From Nature**
Go for a walk, visit your adopted tree or a nearby brook. Feel things, listen to the wind in the trees and the brook as it trickles over small rocks. Look at something familiar in an unfamiliar way — a tree upside down; a flower, as a fly would see it; the feel of soft grass under kitten's paws. A feeling that you want others to feel? Write a haiku or cinquain now before you forget.

**Environmental Experience 2: Every Season as Lovely as the Next**
Is it raining, spring, summer, windy, snowy, fall, winter? No matter what season or weather, go outside! Doesn't that feel better? Soft winds blowing across tiny field flowers bringing spring smells to you. Tiny jewel raindrops tapping patterns on the green, green leaves. Warm summer sun making you feel like a cat stretching sleepily. Cold, crisp air blowing crinkly snow past your face. What is happening — what do *you* see, feel, hear, taste, smell? What if you were small, small as an ant; then how would you feel? What if you were as big and strong as a mountain; how do you feel now?

Try it, you can do it — write a haiku! Or explain the scene; write a cinquain! What is happening right now? Get outside and see!

**Environmental Experience 3: Color My World**
Ask the students to bring in different shades of green, preferably organic objects. Some ideas: limes, unripe bananas, pickles, olives, leaves, lettuce, beans, green apples, pine needles, parsley, cucumbers. Have each student write down how he would arrange them in order from darkest to lightest. Compare the lists and talk about the differences, arriving at a general order. Try to place classroom objects in the list: green crayon, chalkboard, Johnny's sweater. Have the students pick an object and experiment with it: taste it, touch it, smell it, and then describe it in haiku or cinquain.



This can be repeated with different objects, or a poem could be written by a group. Each student could then substitute some of his own adjectives for the ones chosen.
One example of a cinquain for this experience:

Limes
Lemon's cousin
Cool minty green
Citrus tangy and firm
Are sweeter than they seem.

An example of a haiku:
Olives (stuffed with pimento)
Encased in a jar
Crowded in by round green flesh
The red eye glares out.

### Environmental Experience 4: The Cold, Structured World?

Poetry can be written about man-made objects as well as natural ones. Have the student pick out some object he thinks is un-poetical, and then explore how it could become a poem. Telephone poles, manhole covers with patterned designs, airplane streaks in the sky, the useful telephone transmitting news and gossip, sonic booms, city traffic, apartment buildings; they are all prime objects for a descriptive poem, so write!

### Environmental Experience 5: Don't Stop Now, Go On!

As in writing haiku and cinquain, don't stop here; there are many other roads you can take now. Display your poems on bulletin boards, hallway walls, and windows. Design and illustrate poetry books, bumper stickers, buttons to wear on your coat. Illustrate your poems using another ancient oriental art, Japanese brush painting. Act out your poems in small skits.

Go on—there are many, many other types of poetry. Read some and try to write your own.

# Appendix

## TEACHER BACKGROUND INFORMATION

### Haiku: Origin

The hokku or haiku poem is a verse form that the Japanese poets have been working on for many centuries. Originally, it was a part of a poem form known as tanka, a small five-line poem, often played as a game. The first three lines were written or spoken and the last two lines were clapped.

One of the greatest haiku writers was Basho (1644-1694). When he was eight years old he became a servant for a nobleman, who was a lord of a castle in Iga, in the south of Japan. From another servant, he learned the art of writing poetry. His first poem dates from when he was thirteen. At the death of his master, he joined a monastery and continued writing haiku until his death.

Since that time there have been many famous Japanese haiku writers. Much of their work has been translated into English.

Studying haiku offers an excellent starting point for studying Japanese or oriental cultures.

### Style

"Haiku is a three-line, seventeen-syllable poetic form that paints a verbal picture of an experience. Often the poem describes something we may overlook or take for granted. A haiku is the poet's way of conveying his innermost feelings about the world around him. Because the poem is short, the reader must supply much of the meaning through his own past experiences.

"Each poem is like a pencil sketch that the observer may fill in with color or meaning. Each word that is used has a purpose. No word is used unnecessarily. A good haiku is hard to write because the poet must combine acute perception, creative use of words, and a framework for the reader to re-live an experience based on a few suggestive phrases. Often the poet depends heavily on his senses of touch, taste, smell, sight, and hearing to convey his reactions. The writing of haiku can develop attitudes and appreciations about man's relationship with the immediate surroundings, best accomplished when the writer is in direct contact with nature and reality." (Clifford E. Knapp, Environmental Education Coordinator, Ridgewood Schools, Ridgewood, New Jersey.)

A contemporary form of haiku is as follows:
three lines
17 syllables
five in the first line
seven in the second line
five in the third line

### Suggested Steps to Introduce The Unit

The children may need practice in distinguishing words and syllables. Try counting syllables in any poem, and counting the words in the line. Explain that a syllable is a group of letters that make up a sound. Can a line of four words have more syllables than one of five. Explain:

| | |
|---|---|
| The beauty of the earth is | six words: seven syllables |
| Reflected in shimmering rays | four words: eight syllables |
| Beamed down from the sun. | five words: five syllables |

What is the meaning of haiku? Discuss with the students what haiku tries to do: to capture a moment, conveying a clear image as it appears at that time. Have the students try to remember what it feels like to see the first snowfall of the winter, or to go for a ride in a boat. Have them close their eyes and see if they can picture it in their minds. Can you see it? Can you smell it or taste it? Can you feel it? What if you wanted to share this experience with another person who has had this experience — how could you tell them so that they would not only know about it, but actually feel and see what it is like?

Pick a friend and try to tell him about a place you love or something pleasant you remember — describe it so he can feel it, smell it, taste it and see it. This is what a haiku poem tries to do: to capture a feeling on paper so other people can feel it too.

It may be hard at first to write in the style of haiku, but the most important thing is to get the feeling. Good form can come later, so keep trying. If you are having trouble with haiku, try cinquain, another form of oriental poetry.

### Cinquain

Cinquain is more direct description of one thing, whereas haiku is more the transmitting of a feeling that an experience gives. If you ask the students what it would be like to snow, a haiku is probably more appropriate; if you asked them to describe snow, perhaps they should write a cinquain. Both forms are similar, however, in that they are descriptive of one thing at a specified time.

The structure of a cinquain is as follows:
First line: a single noun (person, place, thing)
Second line: two words describing the noun
Third line: three words describing the noun
Fourth line: four words describing the noun
Fifth line: five words, completing a sentence that began with the noun in the first line.

Here are some examples of children's cinquain poetry:
Rain
Wet, clear
Soft, cool drops;
Sprinkles splashing, showers growing,
Seems so nice to me.

Note
High, low
Sounds, up, down
Loud, soft, beat, song
Some notes go straight across.

Grandmother
Nice, sweet
Kind, generous, pretty,
Jolly, friendly, good, lovable
I like my nice grandmother.

Some children's haiku:
Small muddy piglets
Pretty pink ears hear me come.
Friendly muddy pigs.

Pale green grass covers
All the earth's bare ugliness.
Spring has come again.

Dark covers the sky
It looks like a black
Blanket
Everybody sleeps.

Gray fog thickly spreads
Moves silently
  among trees
Hiding everything.

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# Water

A few years ago there was an Earth Day. Do you remember it? Where were you on that day? Did you take part in any of the activities? Strong statements came out of Earth Day — statements of anger for the condition of our country and statements of intent for cleaning up our environment. The task is enormous. Are we on a one way street toward environmental destruction as many people feel? What can be done, if anything?

Sometimes, because there is so much to do, it is hard to see what the individual person or student can do to help improve the environment. While we as individuals may not be able to clean a river or clear the air by ourselves, we can, along with others, become aware of our local problems, through observation and study, and through groups help support those people who have the knowledge and power to do the actual work. A good way to become aware of a problem is to ask people, read newspapers, and look for problems while you are out walking or riding.

There are many types of problems that we must somehow solve, so that we can have a clean environment. Air pollution, solid waste disposal, disease, and water pollution are just a few of these. Maybe the most urgent problem next to air pollution is water pollution. Water is an essential part of life. Without water, our planet would be dry and lifeless like the moon. A man can live for five weeks without food, but he can live only five days without water, and only ten minutes without air. We drink about 4.5 pounds of water every day. Why do we need so much water? The human body is made up of 70% or more of water. Not only do we need water in our bodies. Water is an important part of our personal care, not to mention how much water farms and industries use to grow food and develop products. How does your town or area use water? Part of the solving of the problem is to become aware.

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## WATER

**Unit Objectives:**
Following this experience the students will be able to
1. describe their own feelings about water.
2. calculate the rate of water usage of their family.
3. suggest ways to decrease the use of water in their household.
4. compare present water use with historic water use in their community.
5. present strategies for working with other people to solve community water problems.

### Environmental Experience 1: Gallons and Gallons of Water

Ask the students to define water. How does it look, sound, feel, smell, taste?

Use a haiku, cinquain, or other poem, a sketch, or a story to describe a favorite water scene (a pond, lake, stream).

Encourage the children to tell why they like water or what makes their favorite scene so special.

Ask the children how they could take care of the water at their favorite place. Make a list of things that are good about their favorite water place, and the things that are bad.

Discuss with the children how important water is to plants, animals, and man. Begin to list all of the uses that the children make of water per day.

Ask the children to figure out how much water their family uses in a day. They can figure out what are the major uses of water in their household and school by taking a few simple measurements. For example, a toilet uses about seven gallons of water every time you flush it.

Bath or shower ........................................gallons per day.
Clothes washer ........................................gallons per day.
Washing car ........................................gallons per day.
Washing dishes ........................................gallons per day.
Drinking and cooking ................................gallons per day.
Other ........................................gallons per day.

Does the water leave the house in the same condition it came in? How has it changed? What happens to the waste water after it leaves the house?

Have the children propose ways to cut down on the consumption of water in their households. One activity the children might try is measuring the amount of water coming from leaky faucets. Put a container under the faucet. Use a measuring cup to measure the volume of water you collect in one hour. Multiply the amount by 24, and so forth. Have the children try to calculate the cost of water per gallon and the amount saved by repairing a leaky faucet.

*Additional Activities*

☐ Graph the uses of water, per person in the family, per use, A.M. and P.M.
☐ Graph total for each family in class.
☐ Compare the amount of water used for baths with amount for showers.

### Environmental Experience 2: Uses of Water

Develop a class bulletin board showing how water is used. Each student should bring in magazine pictures and newspaper clippings showing the different ways water is used.

Compare today's use of water with the use of water in the settler period of the local community. Have the children suggest reasons for settlement of the community in its present location. Some factors to consider are access to transportation, water supply, and water power. Often towns were located near water for all three reasons.

Ask the children to compare pioneer life styles with today's life in relation to water use. Have the children look for evidence of human population expansion, by comparing old maps and modern ones of your community.

Ask the children to compare the water supply quantity of pioneer times with the present. Do we have more people today? Do we have more water today? What about the future?

Compare today's source of water with the source from pioneer times. Has it changed? If so, why?

Must the water be treated in any way before use? If so, why? List some things that might contaminate today's water supply that are the same as in settlers' times. List some things that are different.

On the blackboard, trace the water supply system from its source to the school. Include the treatment plant and the stand pipe if applicable.

Plan a tour to trace the drinking water from its source to the school.

### Environmental Experience 3: Working Together

Show a film about contemporary water pollution problems. Design a general activity to show water management problems. This could include bulletin boards, current events, or readings about floods, pollution, water supply, water erosion, and other problems.

Focus on the water problem that most affects the local community and develop an open chart showing the causes of the water problem and possible solutions.

Bring in experts on the problem, including engineers, politicians, ecologists, and others concerned with the problem. Be sure the students see the positive aspects of the problem; i.e., what is being done, how people work together to solve problems, and that the problems are not without solutions.

Next, plan a field trip to observe the water problems of the community.

The experience can be followed by a general class discussion summing up the water problem and possible solutions to the local problems.

The class can formulate *their* own solutions to the problem and forward these solutions to the various people working on the community water problem.

# Appendix

## TEACHER BACKGROUND INFORMATION

Water is one of the three essentials for life, along with food and air. We can live five weeks without food, but only five days without water. Our bodies are made mostly of water (71%). We must consume around 4.5 pounds of water in some form every day. Almost none of the processes that the human body carries on could take place without water.

Besides the water needed directly by man, an enormous amount is needed to provide man with food. It takes about 400,000 gallons of water to make each ton of grain, and of course, animals raised for meat need water to drink. Most of this water is not used up, but is returned to the environment. The water not actually taken up by the roots of the plants eventually will get to the ocean or another large body of water. There the water is evaporated by the heat from the sun. Water also evaporates from small bodies of water, plants, and the land itself. The evaporated water forms clouds which lead to rain, thereby completing the cycle.

This cycle, at first glance, seems to assure that there will always be water but not all the water will be of good quality. Much of the world's water is polluted by man's misuse of it. Half of the water used in the U.S. is used for industry and many of these industrial processes add chemical compounds to the water. Wherever you live, you may find examples of fish killed by chemical wastes or radioactivity in the water, fish dying because the water has been made too hot by an industry, and water that is visibly thick, smelly, and oily.

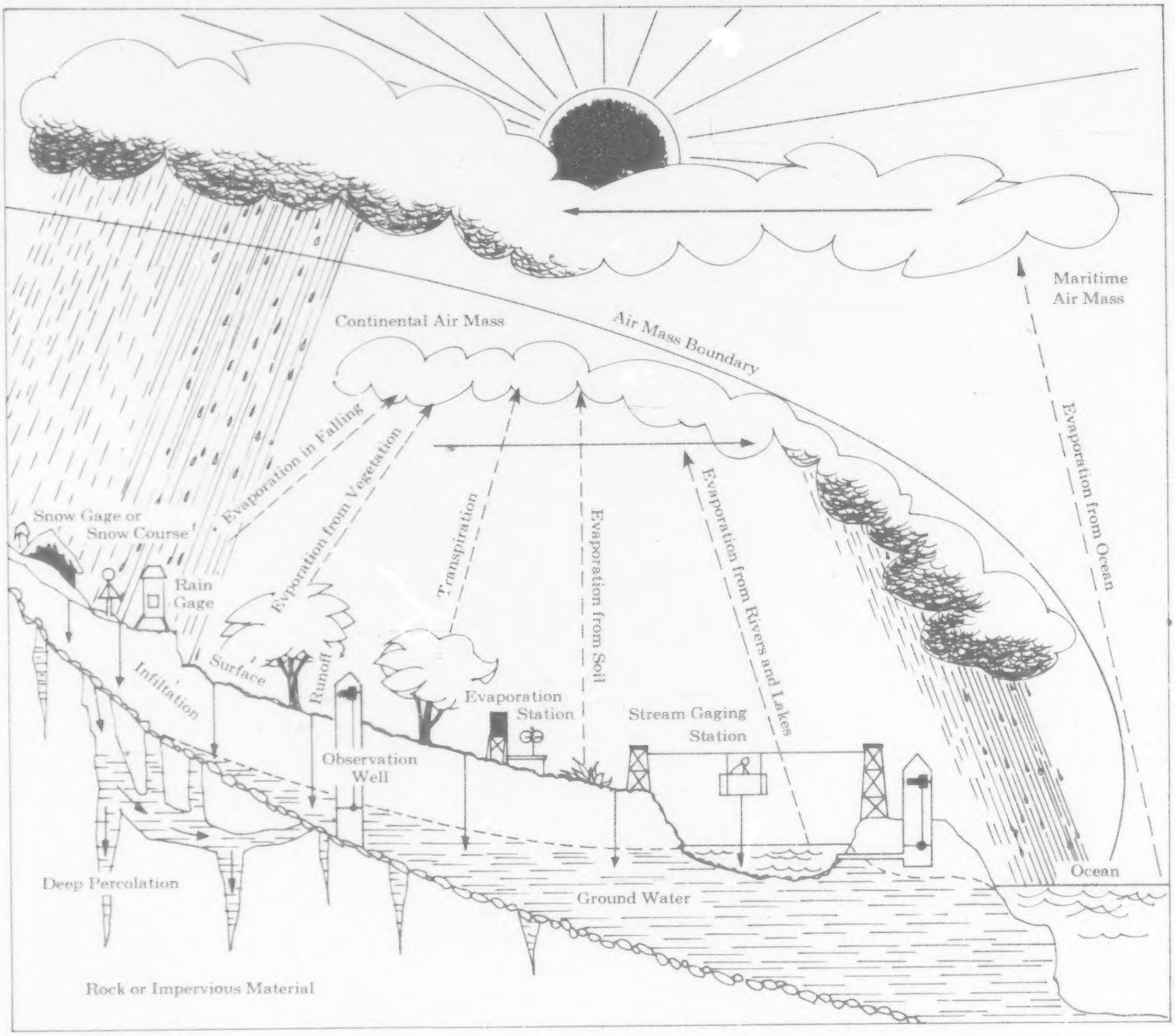
Sewage is one of the largest sources of pollution. Cities in the U. S. are dumping an amount of untreated sewage equivalent to that for 100 million people. This not only endangers health from the large amounts of harmful bacteria and virus present, but also has an effect called eutrophication. Eutrophication is what happens to a body of water in which there is a nutrient enrichment for algae. In such a case, the number of algae present becomes so large that they use up all the oxygen in the water. This is caused not only by sewage, but by high phosphate detergents and by misused fertilizers.

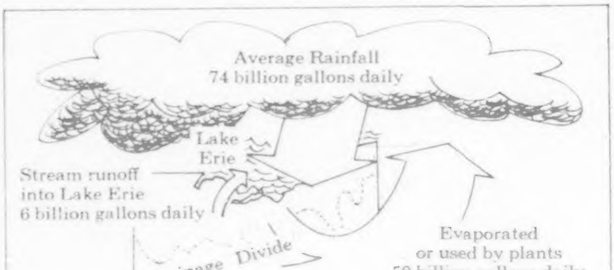
Long-lasting insecticides have found their way into our water, both by air (sprays) and through the ground water. Extremely small amounts of these chemicals are quite dangerous since they are after all intended to be poisons. They cause the additional problem that, in doses too low to affect the animal itself, they frequently make reproduction much less likely, especially for birds. These chemicals are not broken down by nature, and last for a long period of time. They are found in greater concentrations in predatory animals who eat many smaller animals in the contaminated water.

Heat is another form of pollution (thermal pollution). Many industries, particularly nuclear power plants, use great quantities of water for cooling. This heats up the water which in turn heats up the lake or river in the area it is dumped. This has two bad effects. One is that the water has less oxygen in it, so the number of living things, including the bacteria which break down waste, is reduced. Because most animals living in water are cold blooded, the higher temperature can kill them or keep them from reproducing.

Oil and other petroleum products are a major form of pollution by themselves. Oil comes not only from the tanker disasters and the spills from unsound, offshore oil wells, but also from the many industries using oil. Pleasure boats are one of the biggest sources of oil on the water. Water polluted by oil is highly flammable. It is frequently poisonous. One of the worst problems with oil is that it will kill many living things, either directly by coating them or indirectly by cutting off oxygen from the water they are in.

**The Hydrologic Cycle**


Maritime Air Mass
Continental Air Mass
Air Mass Boundary
Evaporation in Falling
Evaporation from Vegetation
Transpiration
Evaporation from Soil
Evaporation from Rivers and Lakes
Evaporation from Ocean
Snow Gage or Snow Course
Rain Gage
Surface Runoff
Infiltration
Evaporation Station
Observation Well
Stream Gaging Station
Ocean
Deep Percolation
Ground Water
Rock or Impervious Material


Average Rainfall
74 billion gallons daily
Lake Erie
Stream runoff into Lake Erie
6 billion gallons daily
Drainage Divide
Evaporated or used by plants
50 billion gallons daily
Stream runoff into Ohio River
18 billion gallons daily

The Water Cycle in Ohio

## Nature's Plumbing System

The journey of water is a fascinating story. From our moisture laden skies, water gets to the earth in rain, snow, sleet and dew. Part of it sinks into the ground; part runs off in stream flow; part evaporates or is used by vegetation and transpires into the atmosphere.

Through the intricacies of nature's plumbing system, water is continually on the move. Water can never be destroyed like coal and wood. There is as much now in the world as there was millions of years ago. Water changes form and the amounts we receive continually change from day to day, year to year, and place to place.

The charts on this page show how water moves (the hydrologic cycle) and the average amounts distributed through this cycle in Ohio.

Our average yearly rainfall in Ohio (37.7 inches) amounts to 27,000 billion gallons. After evaporation and plants use, 8,900 billion gallons run off in our stream and river systems. It's this supply which we tap for our municipal, industrial and farm uses.

Department of Natural Resources
Division of Water

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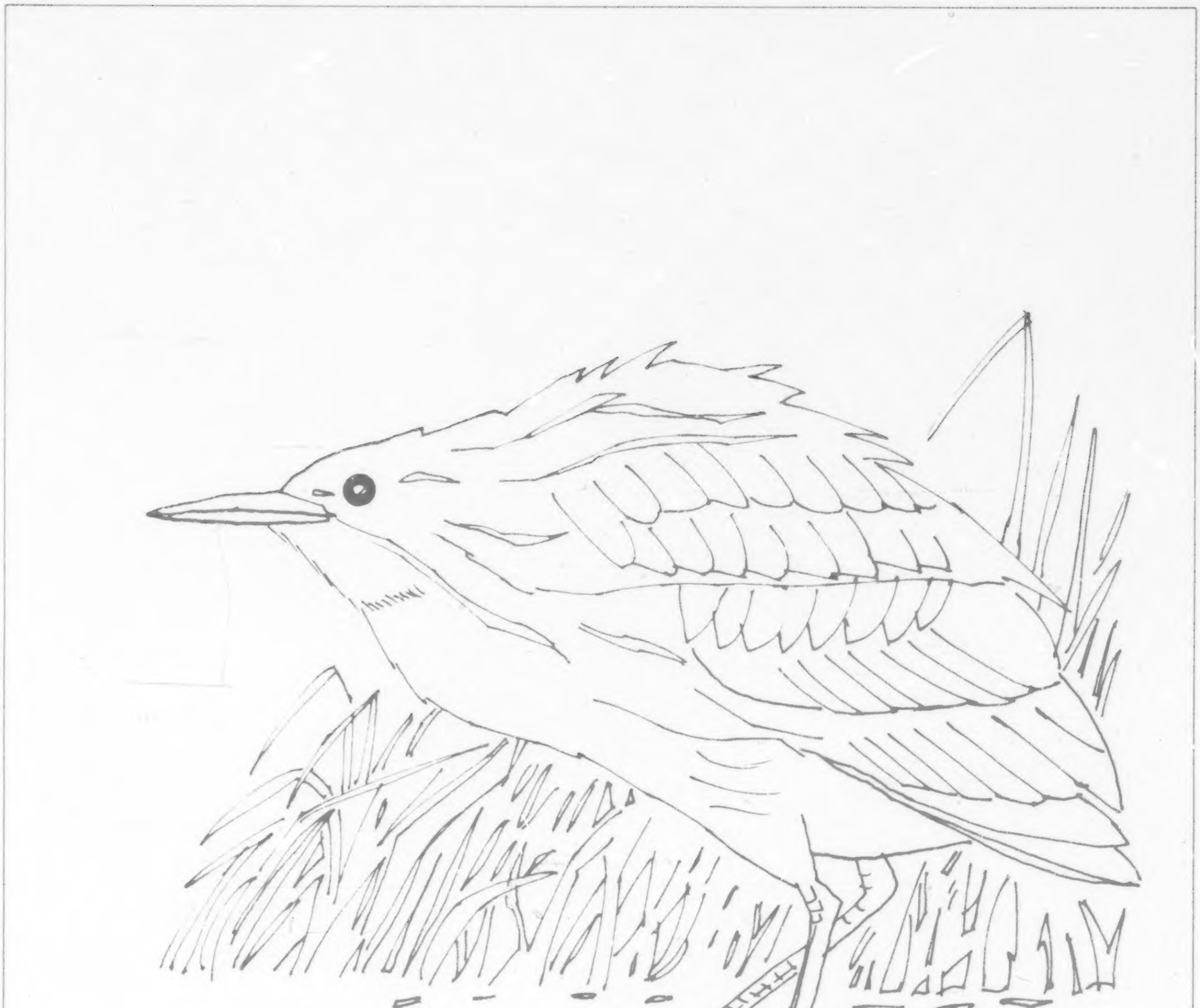

# The Breath of Life— or Death: Air Pollution

Because life is dependent upon water, soil and air, the problems of pollution are important to us all. Following the Industrial Revolution, the air and waters of our world have slowly become more and more polluted; and some of the doomsday prophets tell us that it is so polluted that none of us will survive. Because the study of pollutants is complicated and involves a knowledge of chemistry and other sciences it is often excluded from study in the elementary grades. To foster concern and understanding one must first become aware of the problems. This unit is intended to make the elementary child aware of the problems so that in later grades when a more detailed study of air pollution is made he will have a foundation of awareness and concern on which to build.

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## THE BREATH OF LIFE — OR DEATH: AIR POLLUTION

**Unit Objectives:**

The student will be able to

1. relate his feelings toward smells, good and bad, and air pollution.
2. estimate the relative level of particulate matter in his schoolyard and neighborhood.
3. name and identify the make-up of air using a graphic representation.
4. demonstrate his understanding of the causes of air pollution, their sources and possible cures through participation in a game based on air quality in an imaginary city.

### Environmental Experience 1: Smells

Before the students enter the classroom, spray the room with a scented aerosol spray. Spray it heavily so that the scent lingers in the room as the students enter.

Encourage them to voice what they think the room smells like. Ask them if they have any ideas as to how the room came to smell that way. Now ask the students what their reactions would be if instead of "air freshener," auto exhaust or cigarette smoke had been released in the room. Not only would the smell be unpleasant, but the air would become dangerous to breathe. What could you do to make the air pleasant and safe again? Some might answer, "Open the windows." When you open the windows what have you really done? Impress upon them that all you have done is to replace the polluted air with cleaner air from outdoors and, at the same time, have released the polluted air outdoors.

What is a smell? When is a smell pleasant and when does it become unpleasant? Compile a list of all the pleasant and unpleasant odors you can. Discuss each one, remembering the axiom, "Too much of anything is bad."

| Good Smells | | Bad Smells |
|---|---|---|
| perfume | too much | |
| new car | | |
| air freshener | too much | |
| bathing soap | | |
| ground coffee | | |
| gasoline | too much | |
| glue | | health hazard |
| burnt-out matches | | health hazard |
| sauerkraut | too much | |
| | | skunk |
| | | burning rubber |

*Additional Activities:*

☐ research those products that depend on good smells or the elimination of bad smells, such as perfumes, air fresheners, deodorants, bathroom deodorants, scented candles.

☐ study the sense of smell and how animals use smell for protection and identity.

*Materials:*

Can of air freshener

### Environmental Experience 2: Everything Is Not as It Seems!

How clean is the air really? Sometimes it is easy to tell when the air is polluted because we can see smoke, or smell the pollution. So, when the air is clear and odorless we think we are safe in feeling that the air is pure. It sometimes seems that if we shut down all the factories and stopped all the cars our air would be pure. Ask the children if they feel that Indians had to clean their homes or if the pioneers had to dust their furniture? If the air was perfectly clean, would we have to dust? Have the children think of some of the sources of natural dust. Another clue to the amount of dust in the air is sunsets. As the sun sets, the light reflects off the millions of dust particles in the air, creating beautiful sunsets. It is hard to believe, but the more dust there is in the air the more beautiful the sunsets are. These dust particles floating in the air are often called particulate matter. How much particulate matter is floating around in your classroom, your playground, your home, and the street on which you live? Try some of these experiments and see where the heaviest particulate matter is located in your town. Note that not all particulate matter is man-made; some of it is natural.

What are some sources of natural particulate matter? The natural world not only creates some particulate matter; it has methods to help control it. Rain washes the air, removing much of the dust, thus making the air cleaner. To see the cleaning effect of rain, try some of these experiments before and after rain storms.

*Experiment 1:* (Winter)

Examine the snow along streets and roads. How does its color and texture differ from snow on lawns and fields? Gather up equal amounts of snow from different localities. Place the snow in clean glass dishes. Cover these dishes with a cloth so that no more dust particles can accumulate. Place these containers inside and wait for the snow to melt and evaporate. Is there any difference in the amount of dust in the dishes? Go back and visit the places where you collected the snow. How did the areas differ, and what might be the sources of dust in each area?

*Materials:*

Four to six glass dishes

Equal amount of snow collected from different sites

*Experiment 2:*

Fill buckets or plastic containers with water and place them in several different spots in your school yard or neighborhood. If possible, leave them there for at least two weeks. At the end of the two weeks observe the amount of particulate matter in the containers. If the water has not completely evaporated, heat the container over a low heat until the water evaporates. What area had the most concentration of particulate matter?

*Materials:*

Four to six buckets or containers

*Experiment 3:*
Smear several drinking glasses or pieces of white cardboard with petroleum jelly and place them in different places in your schoolyard or neighborhood. After three days collect them and compare the amount of particulate matter.

*Materials:*
Drinking glass or pieces of white cardboard
Petroleum jelly

*Experiment 4:*
Cover the hose of a vacuum cleaner with a piece of filter paper (the kind you use for coffee works fine), using a string or rubber band. Put the cleaner in the area you wish to test and leave it on for thirty minutes. How much particulate matter was collected on the filter? Run the test in different areas. Check the exhaust of a car. How does this filter compare with the others? Try different types and makes of cars. How do they compare? Keep your filters, label them, and use them as an index of particulate matter.

*Materials:*
Vacuum cleaner
Filter paper
String or rubber bands

*Additional Activities:*
- ☐ Report your results to the rest of the school in the form of a display or bulletin board.
- ☐ Try these experiments at different times of the day or week. When is the particulate pollution at its highest level?
- ☐ Study some of the problems caused by particulate pollution such as black-lung disease caused by coal dust, and hay fever caused by pollen, a natural form of particulate matter.

**Environmental Experience 3: Invisible as the Air Itself**

Some air pollution is not always as easy to detect as the particulate matter is. Air, like water and sunlight, is an essential element of life itself. Without air there would be no life as we know it. What is air? Air cannot be seen as easily as water can, so often it is hard to believe it is really there. For many centuries man was not aware of air, but one of the easiest ways to perceive the presence of air is to feel the wind. Wind is air in motion. There are many simple experiments that show the presence and properties of air. Try some of these in your classroom; they can easily be found in elementary science books.

Air is like a cake in that it is made up of many different ingredients. If all these ingredients were different colors we would see pink, blue, and green waterfalls and streams moving all around us. Cut a piece of graph paper so that it has 100 squares on it. These 100 squares are to represent all the air in the world. Using this table, color in the correct number of blocks for each gas, using a different color for each.

*Relative Amounts of Gases in the Atmosphere*

| | | |
|---|---|---|
| Nitrogen | 78% | or 78 squares |
| Oxygen | 21% | or 21 squares |
| Argon | .94% (1) | or 1 square |
| Neon | .02% | or 2 small dots |
| Other gases | .04% | or 4 small dots |

*Materials:*
Graph paper
Colored pencils or crayon

**Environmental Experience 4: A Deadly Game**

Pollution is a deadly game. Air pollution is one of the serious problems facing our world today. Every day more and more people and areas are feeling the effects of this problem in property destruction, rising costs, and most of all the rise of diseases. Because air pollution is such an important issue and problem, children today need to become aware of this problem so that they will be willing to work for its solution when they are older.

But the study of air pollution, like the study of water pollution, is technical and scientific, involving chemistry and many other sciences. Since the elementary child is not interested in or capable of understanding the exact reactions and effects, it is usually not taught at this level. To remedy this and help the elementary child become aware of the problem, if not scientifically knowledgeable, a simplified study of the question is offered here in the form of a game.

Many of the problems and solutions are simplified so that the child can grasp the overall concept, that of the danger of air pollution and the need for immediate action. The game is arranged somewhat like rummy. The game is based on the relative amount of gases that make up the atmosphere. The goal of the game is to keep your city's air as clean as possible by building up your base amounts of gases and removing the polluting effects through control, elimination, research and the concern of the citizens. Because our controls and research are not perfected today, we can only prevent small amounts of pollutants from entering the air. Therefore, it is worked out in the point system that only half of any pollutants are removed from the atmosphere. A list of the pollutants, their sources, effects, and elimination have been summarized and simplified from some of the current educational materials on the subject. For background information, see the appendix.

To add variety, only one source is given for each pollutant, while in fact the pollutant may come from many sources. Since format prohibits the production of the game in card form, patterns for the cards and a playing board will be included. Xerox copies can be made of these and cut into cards. At the end of each game or each round, each child will be able to check the quality of his air using the air quality standard.

To accomplish this objective, the points had to be altered from the National Air Quality Standard a bit to align with the game. While this may not seem scientifically correct, please remember that the purpose of the game is to make the children aware of the different types of pollution and their overall effect on the environment. If more scientific accuracy is desired, consult government air pollution standards.

### INSTRUCTIONS

Air Pollution: A Deadly Game
For two to four players
Purpose: To keep your city's air as clean as possible.

1. Shuffle the deck and deal out 10 cards to each player.
2. Place the remaining cards face down in the center of the table. Take the top card and place it face up next to the deck. This is your discard pile.
3. The player on the left of the dealer will draw two cards from the deck or one card from the deck and the top card on the discard pile. He may now lay down one element card or one pollution card and its cure per hand. A pollution card cannot be discarded; the only way it can be disposed of is through its cure or being drawn by the next player. Next, the player must discard one card.
4. Player number two will pick one card without looking, from the first player's hand. Next, he will draw two cards from the deck or one card from the deck and the top card from the discard pile. He may now lay down one element card or one pollution card and its cure. Player number two will then discard one card from his hand.
5. Players number three and four will do the same.

*Lose-One-Turn Card:* When a player draws a lose-one-turn card he must declare it to the other players. If he draws it from a player's hand he cannot draw two cards from the deck but must let the next player pick a card from his hand. This leaves him with the same number of cards in his hand. He has lost a chance to lay any cards on the pile. If he draws a lose-one-turn card from the pile he must return the other card to the bottom of the pile and permit the next player to pick a card from his hand.

*Wild Cards:* A wild card can replace any cure card and it is worth the same points.

The player that fulfills all the element requirements exactly can go out if he has one card to discard. The first person to go out receives a bonus of 400 points that are subtracted from his pollution points.

Any pollution card left in your hand at the end of the game is counted against you. Extra cure cards, element cards, lose-one-turn cards or wild cards do not count anything.

**Make Two Copies**

10 NITROGEN
NITROGEN
10 NITROGEN

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NITROGEN
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| 5 NITROGEN<br>NITROGEN<br>5 NITROGEN | 1 NITROGEN<br>NITROGEN<br>1 NITROGEN |
| 1 NITROGEN<br>NITROGEN<br>1 NITROGEN | 1 NITROGEN<br>NITROGEN<br>1 NITROGEN |
| 1 OXYGEN<br>OXYGEN<br>1 OXYGEN | 1 OXYGEN<br>OXYGEN<br>1 OXYGEN |

**Make Two Copies**

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| 10 OXYGEN<br>OXYGEN<br>10 OXYGEN | 8 NITROGEN<br>NITROGEN<br>8 NITROGEN |
| 8 NITROGEN<br>NITROGEN<br>8 NITROGEN | 8 NITROGEN<br>NITROGEN<br>8 NITROGEN |
| 8 NITROGEN<br>NITROGEN<br>8 NITROGEN | 10 NITROGEN<br>NITROGEN<br>10 NITROGEN |

**Make Two Copies**

20 NITROGEN
NITROGEN
20 NITROGEN

1 ARGON
ARGON
1 ARGON

.01 OTHER GASES
OTHER GASES
.01 OTHER GASES

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OTHER GASES
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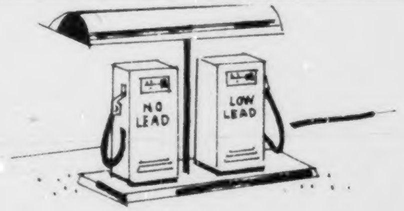
**Make One Copy**

CURE CARD



For 500 Cars Using
Leaded Gasoline

Non-Leaded Gasoline

CURE CARD

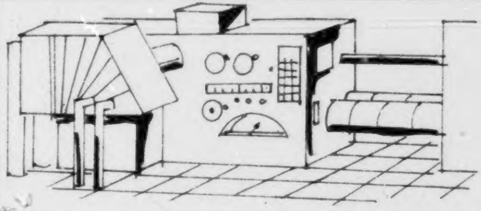
CURE CARD

Cure Card for 25 Miles of New
Surfaced Highway

Anti-Asbestos Law

CURE CARD

CURE CARD

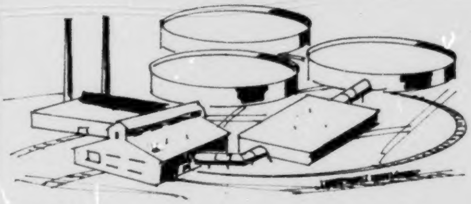


Cure Card for Steel Mill, Aluminum
Plant or Glass Factory

Fluoride Trapper Device

CURE CARD

CURE CARD



Cure Card for Steel Mill, Aluminum
Plant or Glass Factory

Fluoride Trapper Device

CURE CARD

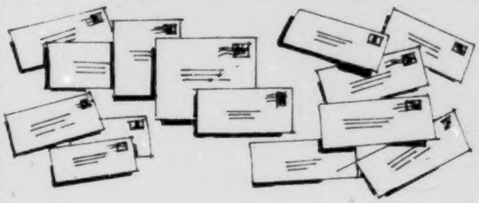
CURE CARD

Cure Card for Steel Mill, Aluminum
Plant or Glass Factory

Fluoride Trapper Device

CURE CARD

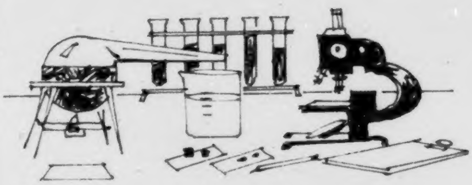
WILD CARD



Anti-Pollution
League Card

WILD CARD

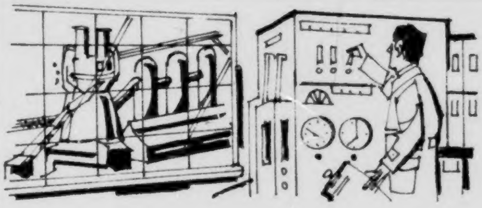
WILD CARD



Research Card

WILD CARD

WILD CARD

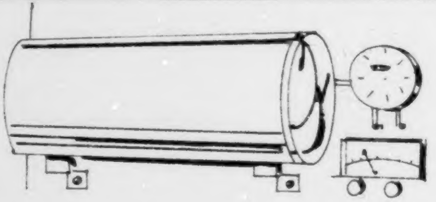


Research Card

WILD CARD

**Make One Copy**

CURE CARD

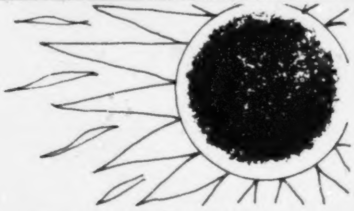


CURE CARD

For 100 Cars

Carbon Monoxide
Control Device

CURE CARD

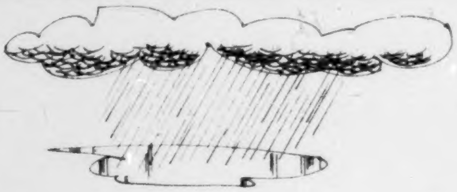


CURE CARD

For 200 Houses Using
Coal and Gas or
500 Coke Ovens

Solar Heat
Card

CURE CARD



CURE CARD

For 200 Houses Using
Coal and Gas

Rain Card

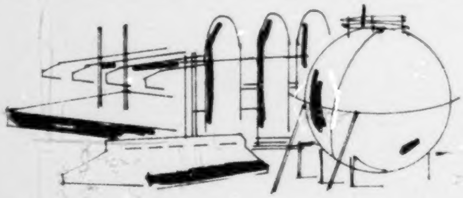
CURE CARD

CURE CARD

For Nuclear Testing—
One Explosion

Ban the Testing Treaty Card

CURE CARD

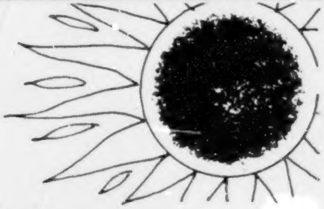


CURE CARD

For One Electric
Power Plant

Nuclear Power Plant

CURE CARD

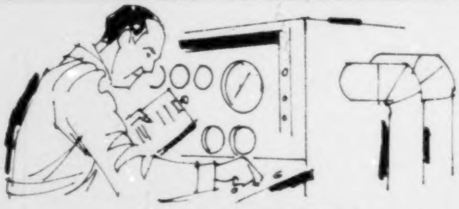


CURE CARD

For 200 Houses Using
Coal and Gas or
500 Coke Ovens

Solar Heat
Card

CURE CARD

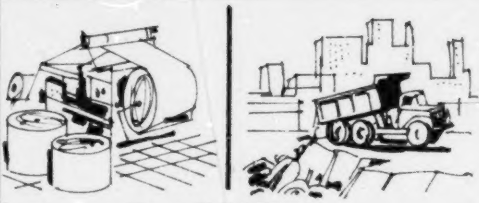


CURE CARD

1000 Gas and Diesel
Trucks

Nitrogen Oxide
Control Device

CURE CARD

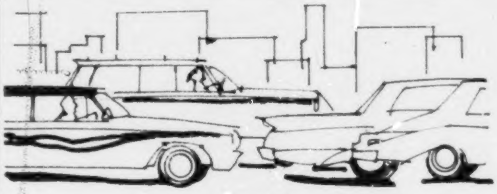


CURE CARD

For 5 Solid Waste
Incinerators

Recycling Center and
Sanitary Landfill

**Make One Copy**



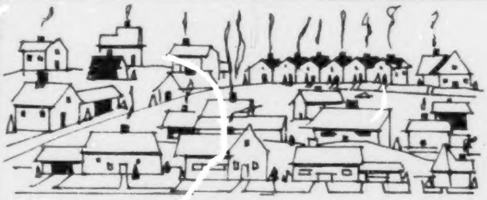
POLLUTION

100 Cars

Carbon Monoxide

Cure: 1 Carbon Monoxide Control
Device Card

POLLUTION



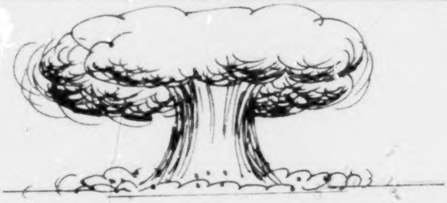
POLLUTION

200 Houses Using Coal and Gas

Particulate Matter

Cure: 1 Solar Heat Card

POLLUTION

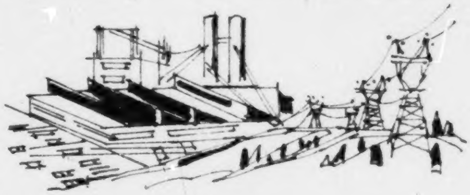


POLLUTION

Particulate Matter
Nuclear Testing
One Explosion

Need: 1 Ban the Testing Treaty

POLLUTION



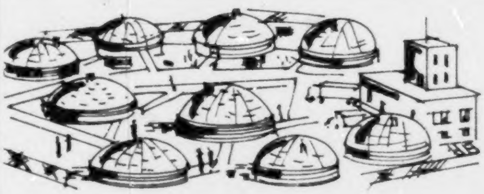
POLLUTION

One Electric Power Plant

Sulfur Dioxide

Cure: 1 Nuclear Power Plant

POLLUTION



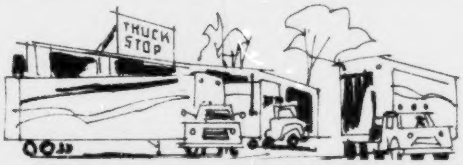
POLLUTION

500 Coke Ovens

Carbon Dioxide

Cure: 1 Solar Heat Card

POLLUTION



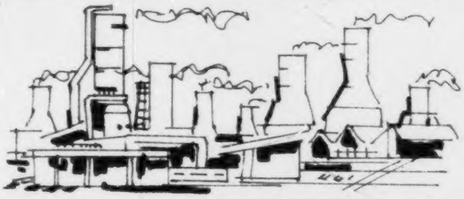
POLLUTION

1000 Gas and Diesel Trucks

Nitrogen Oxide

Cure: 1 Nitrogen Oxide
Control Device Card

POLLUTION



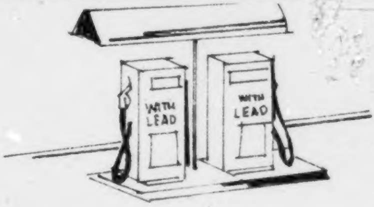
POLLUTION

5 Solid Waste Incinerators

Hydrocarbons

Cure: 1 Recycling Center and
Sanitary Land Fill

POLLUTION



POLLUTION

500 Cars Using Leaded Gasoline

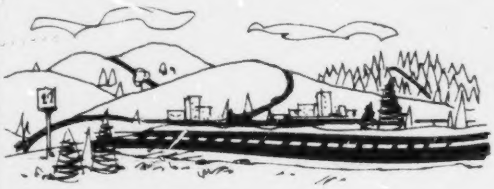
Lead

Cure: Non-leaded Gasoline

POLLUTION

**Make One Copy**

POLLUTION



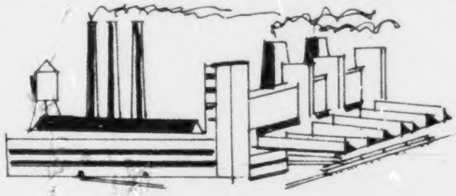
25 Miles of New Surfaced Road

Asbestos

Cure: 1 Anti-Asbestos Law

POLLUTION

POLLUTION



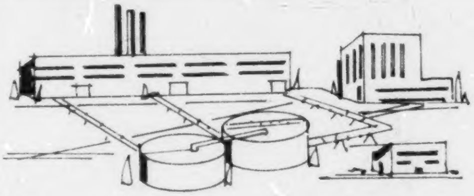
1 Steel Mill

Fluoride

Cure: 1 Fluoride Trapper Device

POLLUTION

POLLUTION



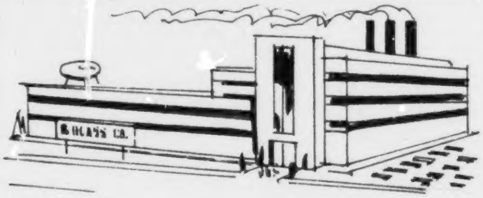
1 Aluminum Plant

Fluoride

Cure: 1 Fluoride Trapper Device

POLLUTION

POLLUTION



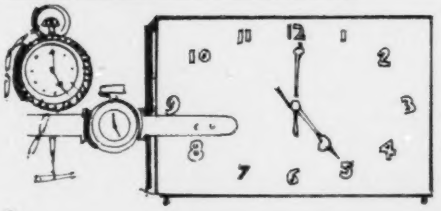
1 Glass Factory

Fluoride

Cure: 1 Fluoride Trapper Device

POLLUTION

WILD CARD

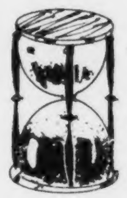


Three Month

Time Card

WILD CARD

WILD CARD



Six Month

Time Card

WILD CARD

LOSE ONE TURN

Lose One Turn

Temperature
Inversion

LOSE ONE TURN

LOSE ONE TURN

Lose One Turn

Temperature
Inversion

LOSE ONE TURN

**Environmental Experience 5: Where the Action Is!** What is being done in your town about air pollution? Who are the major polluters in your area? Read the local paper and contact any local anti-pollution organizations as to what the pollution problems are in your area and what is being done to control them. Attend one of their meetings or have a member come and speak to your class about what you can do to fight air pollution. Write to some national anti-pollution organizations requesting information on their activities. Write to the federal government about the laws and actions taken to control air pollution in the United States. Form an anti-pollution club in your school; hold meetings; investigate local and national air pollution problems; have someone come and talk to you about air pollution detection and ask them to teach you some of the simpler methods. If possible, obtain a milpore kit for your school and use it. Design an anti-air-pollution drive in your school, complete with posters and speeches. Invite the mayor and local officials to attend your rally.

# Appendix

**BACKGROUND INFORMATION FOR AIR POLLUTION: A DEADLY GAME**

| Pollutant | Source | Effect |
|---|---|---|
| 1. Particulate matter<br>fly ash<br>soil<br>metal particles<br>carbon<br>oil<br>rubber particles<br>pollen | Chimneys<br>Nuclear explosions<br>Forest fires<br>Volcanic eruptions<br>Industries | Blackened lung tissue<br>Cancer<br>Allergies<br>Increased heart disease<br>More cases of pneumonia<br>Affects weather<br>Higher cleaning bills |
| 2. Sulfur dioxide | Natural decay of organic materials<br>Volcanic eruptions<br>Industry<br>Smelting of non-ferrous metals, petroleum refining<br>Burning of sulfur bearing coal in electrical power plants | More cases of emphysema and other respiratory problems |
| 3. Sulfur oxides | Sulfur dioxide + water | Irritate eyes and lung tissues<br>Accumulate in crop plants such as wheat, barley, oats, white pine, cotton, alfalfa, buckwheat, sugar beet and others.<br>Kill fish such as salmon<br>Wear and rust exposed metal surfaces and brick and stonework<br>Crack rubber, plastic and paper |
| 4. Carbon monoxide | Combustion from industry<br>cars<br>power plants<br>residential heating<br>refuse disposal<br>Abnormal conditions in plants<br>Cigarette smoke | Thirty minutes of 1,300 rpm is fatal<br>Illness — symptoms —<br>drowsiness<br>nausea<br>dizziness<br>headache |
| 5. Carbon dioxide | Increased use of fossil fuels increases level of $CO_2$ in air. | "Greenhouse effect" on earth's atmosphere which may slowly raise level of temperature causing melting of the poles. |
| 6. Nitrogen oxides | Nitrogen rich fertilizers<br>Burning of fuels, such as coal, oil, natural gas, in<br>gasoline motor vehicles<br>diesel motor vehicles<br>railroads, vessels<br>heating<br>power plants<br>forest fires<br>solid waste disposal<br>industry | Reduce oxygen-carrying capacity of blood<br>Rust metals<br>Trigger smog production |

## BACKGROUND INFORMATION FOR AIR POLLUTION: A DEADLY GAME (Con't.)

| Pollutant | Source | Effect |
|---|---|---|
| 7. Hydrocarbons | Natural sources, as in<br>forests<br>vegetation<br>forest fires<br>bacteria decomposition<br>industry —<br>organic solvent evaporation<br>incineration<br>processing and use of petroleum<br>Cigarette smoke | Smog<br>Lung cancer |
| 8. Ozone | Action of solar ultraviolet energy on oxygen<br>More nitrogen dioxide in air | Chest pain<br>coughing<br>eye irritation<br>Increases susceptibility to bacterial infections<br>Bronchitis<br>Fibrosis<br>Spotting on leaves of green plants<br>Attacks textiles — discolors and disintegrates<br>Deteriorates rubber |
| 9. Lead | Natural component of air, water and soil<br>Coal combustion<br>Manufacturing<br>Pesticide spraying<br>Waste burning<br>Leaded gasolines | More lead in food chains<br>Weather-increased rainfall<br>Lead-poisoning symptoms:<br>headaches<br>loss of appetite<br>dizziness<br>insomnia<br>anemia<br>weakness<br>miscarriage |
| 10. Asbestos | Industry<br>Road surfacing | Mesothelioma — rare tumor conditions<br>Lung cancer |
| 11. Beryllium | Extraction plants<br>Foundries<br>Ceramic manufacturing plants<br>Machine shops<br>Rocket-testing | Eye and skin irritations |
| 12. Fluoride | Industries which manufacture aluminum, steel, phosphate, fertilizers, brick, paints, glass, pottery, and ferro-enamel works | Accumulate in green plants<br>Erode and frost glass |
| 13. Mercury | Processing of mercury ore<br>Industries that use mercury to produce chlorine gas | Mercury disease, brain damage<br>Absorbed by fish |

**SCORING SYSTEM FOR AIR POLLUTION: A DEADLY GAME**

| SOURCE CARD — Pollutant | Points | Cure | End Points |
|---|---|---|---|
| 1. 100 cars—carbon monoxide | 500 | — 250 | 250 |
| 2. 200 houses using coal and gas—particulate matter | 300 | — 200 | 100 |
| 3. Nuclear testing—one explosion—particulate matter | 200 | — 100 | 100 |
| 4. One electric power plant—sulfur dioxide | 200 | — 100 | 100 |
| 5. 500 coke ovens—carbon dioxide | 500 | — 300 | 200 |
| 6. 1000 gas and diesel trucks—nitrogen oxide | 1000 | — 600 | 400 |
| 7. Five solid waste incinerators—hydrocarbons | 600 | — 500 | 100 |
| 8. 500 cars using leaded gasoline—lead | 600 | — 200 | 400 |
| 9. 25 miles of new surfaced highway—asbestos | 600 | — 200 | 400 |
| 10. One aluminum plant—fluoride | 200 | — 100 | 100 |
| One steel mill—fluoride | 200 | — 100 | 100 |
| One glass factory—fluoride | 200 | — 100 | 100 |
| Total | 5100 | —2650 | |

The player who successfully gathers all the points for the elements that make up the atmosphere and goes out first will receive a bonus of 400 points to subtract from his leftover pollution points.

**AIR QUALITY STANDARD:**

| | | POINTS | |
|---|---|---|---|
| LEVEL ONE: | *EXCELLENT* | 0-1000 | Clear air, good visibility, no odor, safe for living and growing of crops. |
| LEVEL TWO: | *GOOD* | 1000-2000 | Reduced visibility, some odor, safe for living and growing of crops. |
| LEVEL THREE: | *FAIR* | 2000-3000 | Reduced visibility, often smoky with frequent odor, eyes water, hard on people with respiratory illness, damage to vegetation. |
| LEVEL FOUR: | *SERIOUS* | 3000-4000 | Poor visibility, very smoky, heavy odors, eyes water, increased coughing and colds, not safe for people with respiratory illnesses, not safe for crop growth. |
| LEVEL FIVE: | *EMERGENCY* | 4000-5000 | VERY BAD — no visibility, heavy odor, acute illness or death, plant death, not safe for more than 48 hours. |

## VOCABULARY LIST:

Good smells
Bad smells
Air pollution
Particulate matter
Filter paper
Black-lung disease
Hay fever
Pollen
Nitrogen
Oxygen
Argon
Neon
Carbon monoxide
Sulfur dioxide
Carbon dioxide
Nitrogen oxides
Hydrocarbons
Lead
Asbestos
Solar heat
Sanitary land fill
Recycle

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**Schools participating in the pilot program between October 1, 1972, and February 15, 1973**

*Central or inner city:*

- Cleveland City Schools
  - Almira Elementary School
  - Charles Dickens Elementary School

*Suburban:*

- Chagrin Falls Exempted Village Schools
  - Sands Elementary School
  - Gurney Elementary School
  - Chagrin Falls Middle School
- Shaker Heights City Schools
  - Malvern Elementary School
- Willoughby-Eastlake City Schools
  - Garfield Elementary School (Willoughby Hills)
  - McKinley Elementary School (Willoughby-on-the-Lake)
  - Royalview Elementary School (Willowick)
- Euclid City Schools
  - Glenbrook Elementary School
  - Upson Elementary School
  - Wells Elementary School

*Rural:*

- Berkshire Local Schools (Burton, Ohio)
  - Burton Elementary School
- Jefferson Local Schools (Jefferson, Ohio)

*Non-public schools:*

- Saint Mary's School (Mentor, Ohio)
- Immaculate Conception School (Willoughby, Ohio)

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